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EPA Superfund
Record of Decision:

NEBRASKA ORDNANCE PLANT (FORMER)
EPA ID: NE6211890011
OU 02
MEAD, NE
04/07/1997

<IMG SRC 971430>
<IMG SRC 97143A>
<IMG SRC 97143B>

October 1, 1996
WCC Project 92KW030M

Commander
U.S. Army Engineer District, Kansas City
ATTN: CEMRK-EP-EC (Ms. Rosemary Gilbertson)
700 Federal Building
601 East 12th Street
Kansas City, Missouri 64106-2896

Re: Transmittal of Final Record of Decision for Signature Pages Completion
For Operable Unit No. 2 (Groundwater)
Former Nebraska Ordnance Plant, Mead, Nebraska
Contract No. DACA41-92-C-0023

Dear Ms. Gilbertson:

We are hereby transmitting seven copies of the subject document. We understand that after the signature pages have been completed, we will distribute copies of the signed document according to the attached distribution list.

On September 30, 1996, we transmitted to you 13 pages of this document which showed revisions from the draft final document in redline/strikeout format. We also copied the transmittal to Mr. Craig Bernstein of the U.S. Environmental Protection Agency and Mr. Troy Bredenkamp of the Nebraska Department of Environmental Quality. Electronic facsimile was used to make the transmittals.

Please contact us should you have any questions.

Very truly yours,

<IMG SRC 97143C<

Enclosure

cc: Steve Iverson (CEMRK-ME-H) w/o enc.
Craig Bernstein (U.S. Environmental Protection Agency)

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OPERABLE UNIT NO. 2
FORMER NEBRASKA ORDNANCE PLANT
MEAD, NEBRASKA

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LIST OF ACRONYMS

AFBMD	Air Force Ballistic Missile Division
AOP	advanced oxidation processes
ARARs	applicable or relevant and appropriate requirements
ARDC	Agricultural Research and Development Center
ATSDR	Agency of Toxic Substances and Disease Registry
CAMUs	corrective action management units
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COCs	chemicals of concern
DNT	2,4 or 2,6-dinitrotoluene
DoD	Department of Defense
DWEL	Drinking Water Equivalent Level
DRE	destruction and removal efficiency
FS	Feasibility Study
GAC	granular activated carbon
HA	Health Advisory
HI	Hazard Indices
IAG	Interagency Agreement
MCL	Maximum Contaminant Level
Ig/L	micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDEQ	Nebraska Department of Environmental Quality
NOP	Nebraska Ordnance Plant
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRD	Natural Resources District
O&M	operation and maintenance
OU	Operable Unit
PCB	Polychlorinated Biphenyl
RAOs	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SMCLs	Secondary Drinking Water Standards
SVE	soil vapor extraction
SVOCs	semi-volatile organic compounds
TBCs	To Be Considered standards
TCE	trichloroethene
TNB	1,3,5-trinitrobenzene
TNT	2,4,6-trinitrotoluene
TRC	Technical Review Committee
TUs	temporary units
USACE	U.S. Army Corps of Engineers
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USEPA	U.S. Environmental Protection Agency
UX0	Unexploded ordnance
VOCs	volatile organic compounds

1.0 DECLARATION

Site Name and Location

Former Nebraska Ordnance Plant
Mead, Nebraska

Operable Unit 2: Contaminated groundwater, explosives-contaminated soil which could act as a source of explosives contamination of groundwater and which does not meet the Operable Unit 1 (OU1) excavation criteria, and soil contaminated with volatile organic compounds (VOCs). Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: NE6211890011

Statement of Basis and Purpose

This decision document presents the selected remedial action for OU2 at the former Nebraska Ordnance Plant (NOP) site near Mead, Nebraska, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record file for this site and has been made by the U.S. Environmental Protection Agency (USEPA) and the U.S. Army Corps of Engineers (USACE), in consultation with the Nebraska Department of Environmental Quality (NDEQ).

Assessment of the Site

Actual or threatened releases of contaminants from this site, if not addressed by implementing the remedial action selected in this Record of Decision (ROD), may present a current or potential threat to public health, welfare, or the environment.

Description of the Selected Remedial Action

The former NOP site was used as an ordnance loading, assembly, and packing facility. Operations at the NOP resulted in contamination of soil and groundwater with explosive compounds. Subsequent to NOP operations, a missile facility was constructed and parts were cleaned on the site. These activities resulted in contamination of groundwater with trichloroethene (TCE). The site has been divided into three operable units. Operable Unit 1 encompasses the upper 4 feet of soil contaminated with explosive compounds. OU2 includes contaminated groundwater, explosives-contaminated soil not remediated during OU1 which could act as a source of explosives contamination of groundwater, and soil contaminated with volatile organic compounds. A former on-site landfill and areas of waste not previously identified are included in OU3.

The remedial action for OU2 addresses one of the principal threats at the site, contaminated groundwater, by containing, extracting, and treating the contaminated groundwater on-site. The major components of the selected remedy include:

- Hydraulically contain contaminated groundwater exceeding the Final Target Groundwater Cleanup Goals.
- Focused extraction of groundwater in areas with relatively high concentrations of TCE and explosives.
- Treat all extracted groundwater using granular activated carbon (GAC) adsorption, advanced oxidation processes (AOP), and air stripping. GAC adsorption and AOP may be applied individually or in combination, while air stripping must be applied in combination with one of the other technologies to effectively treat explosives.
- Dispose of the treated groundwater by beneficially reusing it or through surface discharge.
- Provide a potable water supply to local groundwater users whose water supply contains hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) exceeding the Lifetime Health Advisory (HA) and/or TCE exceeding the Maximum Contaminant Level (MCL).
- Monitor the groundwater elevations and water quality.
- Excavate and treat explosives-contaminated soil which could act as a source of explosives contamination of groundwater and which does not meet the Operable Unit 1 (OU1) excavation criteria.

The OU1 soil remediation will remove all of the identified explosives contaminated soils that pose an unacceptable risk with respect to dermal contact or ingestion. The maximum depth of the OU1 remediation will be 4 feet. Low concentrations of explosives will remain in soil outside and beneath the OU1 remediation areas. These soils which do not meet the OU1 excavation criteria could potentially act as a source of continuing explosives contamination of groundwater and are referred to subsequently as "leaching soils", and are addressed by the OU2 remedy.

Statutory Determinations

The selected remedial action is protective of human health and the environment, complies with Federal and State laws and regulations that are applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedial action utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for a remedial action that employs treatment that reduces toxicity, mobility, or volume as a principal element. A five-year review as specified in CERCLA Section 121(c) will be required for this remedy because hazardous substances will remain on-site in groundwater above health-based remediation goals at the end of five years. No review would be required for the soil remediation.

LEAD AND SUPPORT AGENCY ACCEPTANCE
OF THE RECORD OF DECISION
FORMER NEBRASKA ORDNANCE PLANT SITE
OPERABLE UNIT 2

Signature sheet for the following Record of Decision for Operable Unit 2; contaminated groundwater, explosives-contaminated soil which could act as a source of explosives contamination of groundwater and which does not meet the OU1 excavation criteria, and soil contaminated with VOCS, final action at the Former Nebraska Ordnance Plant site by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency.

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LEAD AND SUPPORT AGENCY ACCEPTANCE
OF THE RECORD OF DECISION
FORMER NEBRASKA ORDNANCE PLANT SITE
OPERABLE UNIT 2

Signature sheet for the following Record of Decision for Operable Unit 2; contaminated groundwater, explosives-contaminated soil which could act as a source of explosives contamination of groundwater and which does not meet the OU1 excavation criteria, and soil contaminated with VOCs, final action at the Former Nebraska Ordnance Plant site by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency.

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2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

The former NOP site occupies approximately 17,250 acres located one-half mile south of the town of Mead, Saunders County, Nebraska as shown on Figure 1. During World War II and the Korean Conflict, bombs, shells, and rockets were assembled at the site. The site includes four load lines, where bombs, shells, and rockets were assembled; the Burning/Proving Grounds, where fuses were tested and materials were destroyed by burning; a Bomb Booster Assembly Area, where boosters that amplify the effect of the detonators and assure the complete detonation of the main explosive were assembled; Administrative Area, which included offices, residences, and a laundry; an Air Force Ballistic Missile Division (AFBMD) Technical Area, where historical information suggests that parts were cleaned; and an Atlas Missile Area. The locations of these features are shown on Figure 2. According to reports, wastewater from both the load line plant operations and the laundry was discharged into a series of sumps, ditches, and underground pipes. Historical information also suggests that TCE was released at the AFBMD Technical Area and the Atlas Missile Area.

The former NOP site is located in the Todd Valley, an abandoned alluvial valley of the ancestral Platte River. The thickness of unconsolidated material above bedrock in the Todd Valley at the site ranges from approximately 81 feet to 157 feet. The unconsolidated material consists of topsoil, loess, sand, and gravel. The uppermost bedrock unit is the Omadi Shale in the northwest and the Omadi Sandstone in the southeast portions of the site.

Three aquifers are present at the site: the Omadi Sandstone aquifer, the Todd Valley aquifer, and the Platte River alluvial aquifer. Three aquitards are present: the Pennsylvanian shales, the Omadi Shale, and the Platte River aquitards. Where the 0madi Shale is absent, the Todd Valley aquifers and the Platte River alluvial aquifer are in hydraulic communication with the Omadi Sandstone and behave as single aquifers without hydraulic barriers.

The water-bearing portions of the unconsolidated material in the Todd Valley are divided into two units, an upper fine sand unit and a lower sand and gravel unit. During the OU2 Remedial Investigation (RI), the sand and gravel unit was found to range from 17.5 to 72 feet thick and the fine sand unit was found to range from 12 to 77 feet thick. The upper fine sand unit is overlain by 4 to 23 feet of the Peoria Loess.

The unconsolidated material in the Platte River Valley, which ranges from 39 to 49 feet thick. Overbank silts and clays ranging from 10 to 17 feet thick overlie the Platte River alluvial sands and gravels.

The water table surface of the Todd Valley slopes toward the south-southeast with depths to groundwater table in the Todd Valley ranging from 6.6 feet to 58.0 feet. A local zone of groundwater discharge is located along the western side of the Platte River floodplain in the southeastern portion of the site. East of Johnson Creek, the water table surface of the Platte River alluvial aquifer slopes to the south, paralleling the Platte River Valley with depths to groundwater table in the Platte Valley ranging from 0.0 to 10.2 feet.

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The site is nearly flat, with a few gentle slopes. Surface water drainage in the eastern portion of the site is generally to the southeast, toward Johnson Creek and the Natural Resources District (NRD) Reservoir. In the western portion of the site, surface water drains to the southwest, toward Silver Creek.

According to the draft National Wetlands Inventory Map for the Mead Quadrangle, a number of wetland types occur in the vicinity of the site, however, these areas will not be influenced by the activities addressed in OU2.

Most of the site is owned by the University of Nebraska, which operates an agricultural experiment station called the Agricultural Research and Development Center (ARDC) on the premises. Crop, hog, dairy, and cattle research take place on site. Other portions are owned by the Nebraska National Guard, United States Air Force, and Army Reserves. Some private pasture and crop production also take place on site, and some private light industry exists near the northern end of the site. Adjacent land use is primarily agricultural, except for the Village of Mead which is located north of the site.

2.2 SITE HISTORY AND PREVIOUS INVESTIGATIONS

2.2.1 Site History

The former NOP was a load, assemble, and pack facility which produced bombs, boosters, and shells. The NOP included four bomb load lines, a Bomb Booster Assembly plant, an ammonium nitrate plant, two explosives burning areas, a proving range, a landfill, a wastewater treatment plant, analytical laboratories, and storage and administration facilities. Most of the raw materials used to manufacture the weapons were produced at other locations and shipped to the NOP facility for assembly. However, ammonium nitrate was produced at the Ammonium Nitrate Plant during the first months of operation. Finished munitions, bulk explosives, and related ordnance materials and components were stored and demilitarized at the site.

Routine plant operations included washout of explosive materials prior to bomb loading and assembly, and bomb washing following assembly. Wash water was discharged to sumps and in open ditches.

The production facilities were active during both World War II and the Korean Conflict. The Nebraska Defense Corporation operated the NOP for the Army from 1942 until 1945 and produced munitions which were loaded with trinitrotoluene (TNT), amatol (TNT and ammonium nitrate), tritonal (TNT and aluminum), and Composition B (RDX and TNT). Tetryl boosters were assembled for bombs in the Bomb Booster Assembly Area. In 1945, ordnance production operations were terminated, and the facilities and operations were placed on inactive status.

During the interim period (1945 through 1949), the NOP was decontaminated and used primarily for storage and disposal of bulk explosives and munitions, and production of ammonium nitrate for use as fertilizer. Decontamination consisted of flushing and sweeping buildings that were not being used for storage. After decontamination operations were completed, explosives residues in the sumps, settling basins, pipelines leading to the drainage ditches, and an unspecified quantity of contaminated soil and sludge from the drainage ditches were removed and reportedly taken to the Burning/Proving Grounds. In some instances, portions of the tile pipe composing the drainage system from the sump to the open ditches were removed and disposed.

In 1950, the plant was temporarily reactivated and produced an assortment of weapons for use in the Korean Conflict. The NOP was placed on standby status in 1956 and declared excess to Army needs in 1959.

After the NOP was declared excess in 1959, it was transferred to the General Services Administration for disposition. Approximately 1,000 acres were retained by the Army for National Guard and Army Reserve training, 12 acres were retained by the Amy for use as a Nike Missile maintenance area, 2,000 acres were transferred to the U.S. Air Force to build the Offutt Air Force Base Atlas Missile Site, and 40 acres were transferred to the Department of Commerce. From 1959 to 1960, the Offutt Air Force Base Missile Site S-1 launch area (Atlas Missile Area) was built on 1,185 acres north of Load Line 4. TCE was used during construction to degrease and clean pipelines used to carry liquid oxygen fuel for missiles. Historical information suggests that TCE was released as ground spills and/or discharged into surface drainage features during the construction activities. The exact locations, quantities, and dates of TCE disposal are not known. The missile facilities were abandoned in 1964, and the Atlas Missile Area and the Nike Area were transferred to the Nebraska National Guard. The U.S. Air Force also occupied 34 acres of the northern portion of Load Line 1 for use as the AFBMD Technical Area. The purpose of the AFBMD Technical Area is unclear, but historical site information suggests that parts were cleaned with TCE in a laboratory, and the spent TCE was discharged into the sewer. The potential TCE soil contamination is not located in the area contaminated with explosives. In 1962, approximately 9,600 acres of the former NOP site were purchased by the University of Nebraska for use as an agricultural research farm which is now the ARDC, and an additional 600 acres were obtained in 1964. The remaining 5,250 acres were eventually purchased by private individuals and corporations.

Since NOP closure, the property has been used primarily for agricultural production and research. In addition to these land uses, several commercial operations were conducted on former NOP property. Apollo Fireworks operated for a period of approximately 20 years until 1989 in the Bomb Booster Assembly Area. At the former administration buildings, various commercial enterprises were in operation including insulation board manufacturing and expanded styrene foam packing material processing. Property was leased for these and other purposes by private individuals.

Several environmental investigations (discussed below) resulted in the listing of the former NOP site on the National Priorities List (NPL) under Section 105 of CERCLA on August 30, 1990. In September 1991, USACE, USEPA, and NDEQ entered into an Interagency Agreement (IAG)under Section 120 of CERCLA to investigate and control environmental contamination at the former NOP site.

2.2.2 Previous investigations

Soil

Previous investigations include an archives search for the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA, now called Army Environmental Center) in 1983; Polychlorinated Biphenyl (PCB) investigations by the University of Nebraska in 1984 and 1985, USEPA in 1988, and USACE in 1993; a soil, sediment, surface water, and groundwater investigation by USACE in 1989; a shallow soil gas investigation in 1990; a soil investigation by the USACE in 1991; an unexploded ordnance (UXO) survey and soil investigation by USACE Lin 1991; a preliminary health assessment by the Agency of Toxic Substances and Disease Registry (ATSDR) in 1991; and a Supplemental Soil RI for OU1 by USACE in 1991.

The 1983 archives search was conducted to assess the potential for contamination at the NOP site from Army operations. Findings of the Archive Search Report were based primarily on the U.S. Army Ordnance Ammunition Command's 1959 Survey of Explosives Contamination. Areas recognized in the Archives Search Report as having the greatest potential for explosives-contamination were the four load lines, the Bomb Booster Assembly Area, and the Burning/Proving Grounds.

In 1989, USACE conducted a confirmation study to determine if past Army activities at the NOP site resulted in environmental contamination. A geophysical survey was conducted to screen boring locations and locate buried materials. The study concluded that explosive residues are present in soil around three of the load lines.

In 1991, USACE identified and assessed potential sources of explosives contamination and UXO. USACE performed a records review and site inspection which included excavation of two test pits and collection of 18 soil samples. Locations potentially requiring remedial action were identified as those where solid pieces of TNT were visibly present or where TNT was found in soil at concentrations greater than 2 percent by weight. The areas identified based on these criteria were at three of the load lines and parts of the Burning/Proving Grounds.

ATSDR completed its Preliminary Health Assessment in 1991. ATSDR concluded that potential human exposure to hazardous substances at the former NOP may result in adverse health effects. It was concluded that the public could be exposed to the explosive compounds RDX and TNT via skin contact or soil ingestion.

In 1991 and 1992, USACE conducted an OU1 RI to evaluate the extent (area and depth) of explosives-contaminated soil at the former NOP site. Most sampling was based on historical washwater disposal practices during the ordnance production process. Explosives compounds were detected in soil in all four load lines, the Bomb Booster Assembly Area, and the Burning/Proving Grounds. No significant explosives contamination was identified in the Administration Area. No live ordnance was found on-site.

OU1 RI results indicate that explosives contamination in soil is mostly limited to soils in and under drainage ditches and sumps in the load lines and the Bomb Booster Area. It is believed that this contamination originated from the discharge of water used to wash away explosives dust and residue which resulted from the ordnance load, assemble, and pack process. In the Burning/Proving Grounds, testing and burning activities probably contributed to soil contamination. The majority of the explosives contamination was detected in shallow soil. At some locations, however, explosives compounds were detected at depths of approximately 30 feet below the surface. Explosives contaminant concentrations in the ditches generally decreased downstream from collection sumps. TNT, RDX, and 1,3,5-trinitrobenzene (TNB) were the explosives contaminants most often detected. The OU1 results are presented in the Supplemental RI Report for OU 1.

Based on the PCB investigations, PCB-contaminated soil was identified in locations associated with former transformer pads and subsequently removed by the University in 1985 and USACE in 1994 and 1995. Removal of remaining PCB-contamination is ongoing. Unexploded ordnance has not been found on-site, but some internal components of ordnance (booster adapters, fuses, propellants, and bulk TNT) were found and disposed. Investigation of unexploded ordnance is ongoing at the site. Documents related to the site are available for review in the information repository at the Ashland Public Library.

Groundwater

Groundwater sampling was initiated by USACE during the 1989 Confirmation Sampling when samples were collected from monitoring wells and water supply wells. RDX, TNT, and TCE were identified in the groundwater samples. Some of the TCE concentrations exceeded the MCL of 5 micrograms per liter (Ig/L). As a result of the Confirmation Study, carbon filtration systems were installed at two residences southeast of the former NOP, a carbon filtration system was installed at the ARDC Agronomy Building, and two ARDC water supply wells were removed from service. Subsequently, the water supply well sampling was continued on a periodic basis. Additional residences were identified where the TCE concentrations exceeded the MCL or the RDX concentrations exceeded the HA of 2 Ig/L. Currently, water is being treated and/or bottled water is being supplied at four private residences which are all southeast of the former NOP. In addition, water is being treated with GAC adsorption at 26 ARDC locations.

In late 1989 and early 1990, a soil gas survey was conducted by USACE to evaluate areas of soil that may be contributing TCE contamination to groundwater. TCE and other VOCs were detected in some samples; however, source areas were not definitively identified.

USACE installed and sampled additional monitoring wells prior to the OU2 RI.

2.2.3 Summary of OU2 RI Results

USACE conducted an OU2 RI in 1992 to evaluate the nature and extent of potential chemicals of concern (COCs) in the groundwater at the former NOP site attributable to past Department of Defense (DoD) activities. The secondary objective was to evaluate the potential nature and extent of VOC contamination in soils at three areas (Administration Area, Atlas Missile Area, and the AFBMD Technical Area) to assess whether or not these contaminated areas are possible continuing sources of VOCs in the groundwater. Groundwater samples were also collected from 136 monitoring wells and were analyzed for VOCs, explosives compounds, and general water quality parameters. Selected monitoring wells were also analyzed for semi-volatile organic compounds (SVOCs) and metals. Soil and soil gas samples were collected and analyzed for VOCs. Field data were also collected to characterize the geology at the former NOP site, and to estimate the direction and rate of groundwater flow. Groundwater samples were collected from every monitoring well on a quarterly basis beginning during the OU2 RI (August 1992) and continuing for one year. Subsequent sampling has been performed periodically at selected monitoring wells, and the monitoring program is ongoing.

The OU2 RI identified four groundwater contamination plumes with separate source location identified for each plume. Two of the plumes consist of explosives contaminated groundwater (primarily RDX) and two of the plumes consist of primarily TCE-contaminated groundwater. The plumes overlap in two arm where both TCE and RDX are in the groundwater in the same location. Both the TCE plume with its source at the Atlas Missile Area and the explosives plume with its source at Load Lines 2, 3 and 4 extend past the eastern boundary of the former NOP.

Higher groundwater contamination was found in the upper fine sand units than in the sand and gravel units below. Generally, lower contamination was found in the deepest of the three aquifers which is the Omadi Sandstone aquifer. Table 1 lists the ranges of the COCs detected in groundwater.

The OU2 RI data indicated that the Administration Area was not a continuing source of groundwater contamination. However, data did not conclusively indicate whether the Atlas Missile Area or the AFBMD Technical Area are, or are not, continuing sources of TCE to groundwater. The data do indicate TCE groundwater contamination did originate in those areas.

Subsequent to the OU2 RI, a Groundwater Containment Removal Action was developed to stop the spread of the TCE plumes. The implementation of that removal action awaits acquisition of necessary easements for property access. If the containment of the TCE plumes is not accomplished by this removal action, it will be conducted as a part of the remedial action instead. Section 2.6 contains more details regarding the Groundwater Containment Removal Action.

Table 1

Range of COC Concentrations Detected in Monitoring Well Samples

Contaminant of Concern	Range of Detected Concentrations on MWs Maximum (Ig/L)	Minimum (Ig/L)
Methylene chloride	610	0.5 JB
1,2-dichloropropane	27	0.7J
TCE	4800	0.6J
TNB	4	0.1
TNT	39	0.10
RDX	534	0.08
2,4-DNT	1.9	0.13

Notes:
1) J = Below Quantitation Limit (estimated)
2) B = Compound also detected in laboratory blank
3) TCE = Trichloroethene
4) TNB = 1,3,5-trinitrobenzene
5) TNT = 2,4,6-trinitrotoluene
6) RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
7) 2,4-DNT = 2,4-dinitrotoluene

2.3 COMMUNITY PARTICIPATION

Community participation activities provide the public with an opportunity to express their views on the preferred remedial action. USEPA, NDEQ, and USACE consider public input from the community participation activities in selecting the remedial alternative to be used for the site.

Community participation was provided in accordance with CERCLA, as amended by SARA. Community participation highlights include the availability of several key documents in the administrative record, public comment periods, and public sessions.

A Community Relations Plan for the former NOP site was prepared by USACE, and approved by USEPA and NDEQ in May 1992. This document lists contacts and interested parties throughout government and the local community. It also establishes communication pathways to ensure timely dissemination of pertinent information.

A Technical Review Committee (TRC) was established to insure that the cleanup of the former NOP site would be carried out in the best interests of the communities involved. The TRC periodically meets and reviews and comments on all official plans and documents and advises the appropriate agencies before decisions are made regarding activities at the site.

Public meetings were held at the ARDC in July 1989 and in June 1990 to discuss the progress of the ongoing studies at the site and to give the community a chance to voice their concerns and offer comments. A public meeting and availability session in June 1994 and a public availability session in February 1995 were held primarily to address OU1-related concerns; however, personnel familiar with OU2 activities also addressed OU2-related concerns. Both meetings were held at the ARDC.

USACE and USEPA released the OU2 Proposed Plan on October 13, 1995 and made it available for public review and comment. The information repository for the site has been established at the Ashland Public Library, 207 North 15th Street, Ashland, Nebraska. The information repository contains the administrative record including the RI report, Baseline Risk Assessment, Feasibility Study (FS) Report, Proposed Plan, and other documents relevant to the former NOP site. This information was made available to the public to facilitate public input concerning the investigation, remediation evaluation process, and preferred alternative identification.

Legal notice of the Proposed Plan and the Public Meeting was included in the Wahoo Newspaper and the Ashland Gazette on October 19, 1995. Legal notice advertisements also appeared in the Lincoln Star, Lincoln Journal, and the Omaha World-Herald on October 16, 1995. A press release announcing the release of the Proposed Plan and the Public Meeting date were provided to the Wahoo Newspaper, the Ashland Gazette, the Lincoln Journal, and the Omaha World-Herald. A press release was also provided to National Public Radio and KOLN-TV in Lincoln and WOWT-TV and KETV in Omaha. A public comment period on the Proposed Plan was held from October 30, 1995, to November 29, 1995. The Proposed Plan was presented at a

Public Meeting held on November 8, 1995, at the University of Nebraska-Lincoln ARDC Research and Education Building at the site. At this meeting, representatives of USACE, USEPA, and NDEQ answered questions from the public about the former NOP site and the OU2 remedial alternatives under consideration.

All comments received by the USEPA and the USACE during the public comment period, including those expressed at the public meeting, are addressed in the Responsiveness Summary which is included with this document.

This ROD presents the selected remedial action for OU2 at the former NOP site near Mead, Nebraska, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP. The decision for this site is based on the administrative record.

2.4 SCOPE AND ROLE OF OPERABLE UNIT 2 REMEDIAL ACTION WITHIN THE SITE STRATEGY

Early site characterization activities identified some sources of contamination that could be addressed before full characterization activities were complete for other sources. USACE, in consultation with NDEQ and USEPA, organized the response actions into three OUs. These are as follows:

- Operable Unit 1: The upper 4 feet of soil contaminated with explosives compounds.
- Operable Unit 2: Contaminated groundwater, explosives-contaminated soil which could act as a source of explosives contamination of groundwater and which does not meet the OU1 excavation criteria, and soil contaminated with VOCs.
- Operable Unit 3: An on-site landfill and other disposal areas not identified at the signing of the IAG.

Investigations and remediation feasibility evaluations have been or are conducted in accordance with the OU designations. A record of decision selecting soil excavation and incineration as the remedy for OU1 was signed November 1995. The OU3 RI is currently ongoing.

The objectives of the OU2 remediation are to:

- Minimize the potential for ingestion of contaminated groundwater, or reduce concentrations to acceptable health-based levels.
- Minimize the potential for dermal exposure to contaminated groundwater, or reduce concentrations to acceptable health-based levels.
- Minimize the potential for inhalation of chemicals released during the use of contaminated groundwater, or reduce concentrations to acceptable health-based levels.

Data collected during the OU2 RI indicated that the soils at the Administration Area are not continuing sources of TCE to groundwater. Other RI data did not conclusively indicate that the soils at the Atlas Missile Area and the AFBMD Technical Area are, or are not, continuing sources of TCE to groundwater. The data included soil gas data which indicated the presence of TCE; however, the TCE concentrations measured by a laboratory in the soil samples did not correspond to the soil gas concentrations measured in the field. Pilot-scale soil vapor extraction (SVE) studies to address the TCE-containing soil gas at the Atlas Missile Area and the AFBMD Tech Area were also performed. While the pilot study concluded there is a recoverable mass of TCE at these areas, the quantities of TCE present do not merit implementation of full scale SVE remediation. Therefore, remedial actions to address VOCs in soil vapor are not proposed. However, in the event TCE in soil vapor should contribute additional contamination to groundwater, that contamination would be addressed by the focused extraction system.

The selected alternative includes the following processes to meet the objective identified above:

- Hydraulically contain contaminated groundwater.
- Focused extraction of groundwater in areas with relatively high concentrations of TCE and explosives.
- Treat all extracted groundwater using granular activated carbon (GAC) adsorption, advanced oxidation processes (AOP), and air stripping. GAC adsorption and AOP may be applied individually or in combination, while air stripping must be applied in combination with one of the other technologies to effectively treat explosives.

- Dispose of the treated groundwater by beneficially reusing it or through surface discharge.

- Provide a potable water supply to local groundwater users whose water supply contains RDX exceeding the HA and/or TCE exceeding the MCL

- Monitor the groundwater elevations and water quality.

- Excavate and treat leaching soils using the same methods as, and concurrently with, OU1 remedial activities.

This alternative will protect both human health and the environment. Groundwater containment, extraction, and treatment is expected to prevent the spread of COCs to new areas; soil excavation and treatment is expected to remove a potential source of explosives contamination of groundwater; and potable water supply is expected to prevent human consumption of water which contains unacceptable COC concentrations. In addition, groundwater containment, extraction, and treatment will eventually restore the aquifer so that groundwater can be used in a beneficial manner directly without treatment.

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2.5 SUMMARY OF SITE CHARACTERISTICS

Results of the OU2 RI indicate that there are two groundwater contamination plumes which consist primarily of TCE-contaminated groundwater, and two plumes which consist primarily of RDX and other explosives compounds. These four groundwater plumes are shown on Figure 3. Higher groundwater contamination was found in the upper fine sand units than in the underlying sand and gravel units and lower contamination was found in the bedrock aquifer. The concentration range of the COCs are given in Table 1. Six of the seven COCs are classified as possible or probable human carcinogens, and all seven may cause noncancer health effects. Potential risk from ingestion, dermal exposure, or inhalation of these compounds is discussed in more detail in Section 2.7, Summary of Site Risks.

The fate and transport of the COCs were analyzed as a part of the OU2 RI to identify off-site areas potentially affected by contamination and to estimate contaminant concentrations in those areas. The fate and transport analysis was a multiple step procedure which consisted of screening the potential routes of contamination, identifying the persistence of the contaminants in terms of their physicochemical properties, and quantitatively simulating contaminant migration for the predominant transport mechanisms identified during the screening process. The concentrations which were estimated using the analytical model were compared to concentrations measured in the monitoring wells. The validity of representing both the off-site areas potentially affected by contamination and the off-site contaminant concentrations derived from the OU2 RI nature and extent characterizations were confirmed by the comparison.

The estimated volume of groundwater with COC concentrations exceeding the Final Target Groundwater Cleanup Goals is approximately 23 billion gallons, or 69,000 acre-feet, underlying approximately 6,000 acres as shown on Figure 3. The Final Target Groundwater Cleanup Goals are described further in Section 2.8.

The OU1 soil remediation will remove all of the explosives contaminated soils that pose an unacceptable risk with respect to dermal contact or ingestion. The maximum depth of the OU1 remediation will be 4 feet. Low concentrations of explosives will remain in soil outside and beneath the OU1 remediation areas. These unremediated soils could potentially act as a source of continuing explosives to groundwater and are referred to as "leaching soils". The OU2 FS Report details the criteria which were used to determine the locations of the leaching soils shown on Figures 4 through 7. The criteria which define theses leaching soils were developed using a combination of the HYDRUS Model, a modified version of the Summers Model, and the Batch Flushing Model. The HYDRUS Model was used to predict the movement of explosives through the unsaturated zone, and the modified Summers Model was used to predict the resulting groundwater concentration after the leachate reached the saturated zone. The concentration of groundwater contamination resulting from the leaching soils was plotted against time, and the time that the groundwater concentration fell below the clean up goals was noted. The Batch Flushing Model was used to estimate the restoration time frame for groundwater contamination assuming that leaching soils did not contribute any contamination to the saturated zone. The restoration time frame estimate was compared to leaching time determined during the unsaturated zone analysis.

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The leaching soils volume is estimated to be 2,600 cubic yards. The OU2 FS Report details the procedures which were used to estimate the remediation areas and volumes.

2.6 REMOVAL ACTIONS

Five removal actions have been conducted to address potential risk from COC contamination in existing drinking water on the former NOP site. Four of those removal actions consisted of installing point-of-entry or point-of-use granular activated carbon adsorption treatment systems in private residences or University of Nebraska ARDC facilities. The fifth action consisted of supplying bottled water to a private residence.

A Groundwater Containment Removal Action has been developed for the site to allow an early start for the TCE containment, which otherwise will take place under this ROD. The specific objectives for this removal action are:

- Hydraulic containment of groundwater contamination to minimize expansion of the two TCE contamination plumes prior to the initiation of the remedy. The Groundwater Containment Removal Action is being conducted to stop the downgradient movement of the TCE plumes

- Protection of unimpacted downgradient groundwater users.

- Treatment and discharge of extracted groundwater to meet applicable standards.

- Periodic monitoring of the effectiveness of the containment system.

Because all of the proposed alternatives for the OU2 remedy at the site, except for the no action alternative, include the element of hydraulic containment, the Groundwater Containment Removal Action will be consistent with the final remedy. TCE containment work, if not carried out as a removal action, will take place during the remedial action described in this ROD.

2.7 SUMMARY OF SITE RISKS

CERCLA requires protection of human health and the environment from risks due to current and potential future exposure to releases of hazardous substances at or from a site. As part of the OU2 RI/FS, a Baseline Risk Assessment was prepared to evaluate potential human health risks associated with exposure to contaminated groundwater and subsurface soils in the absence of any remedial action. Potential risks were estimated based on a number of assumptions, including the populations that could be exposed to site contaminants and the likely magnitude of any such exposures.

It was concluded that actual or threatened releases of contaminants from this site, if not addressed by implementing the remedial action selected in this Record of Decision, may present a current or potential threat to public health, welfare, or the environment.

2.7.1 Potential Human Health Risks

A detailed Baseline Risk Assessment was performed to characterize risks to both current and hypothetical future populations. The key components of the risk assessment included a chemical analysis section that identified the site-related chemicals, an exposure assessment that identified potentially exposed populations and intake assumptions, a toxicity assessment that identified chemical specific toxicity values, a risk characterization that quantified potential risks, and an uncertainty section that identified the primary sources of uncertainty associated with the risk assessment and the likely impacts of these uncertainties on the results.

<u>Identification of Site-Related Chemicals</u>

An evaluation of site groundwater data identified several VOCs, SVOCs, explosives, and one metal that appeared to be contaminants related to the former NOP site. In addition, several site-related VOCs were identified in subsurface soil at the former Atlas Missile Area and Load Line 1. These chemicals were evaluated quantitatively in the risk assessment.

<u>Exposure Assessment</u>

An evaluation of local populations and land use was used to identify exposure scenarios for quantitative evaluation in the risk assessment. Potential risks were estimated for both current and future use scenarios. Site workers, and child and adult residents were evaluated for potential exposure to groundwater from the two most-contaminated monitoring wells found on-site (MW-5B and MW-40B), while construction workers were evaluated for potential exposure to subsurface soils during excavation activities and subsequent showering in water from the two most-contaminated wells. These populations are believed to have the greatest potential for exposure at the site. For site workers and residents, potential groundwater risks were evaluated quantitatively for three exposure pathways (ingestion, inhalation, and direct dermal contact). For construction workers risks were evaluated for ingestion, inhalation and direct dermal contact with subsurface soil, as well as for inhalation and direct dermal contact with groundwater while showering. Upperbound exposure concentrations and parameters were selected to estimate risks associated with Reasonable Maximum Exposure (RME), while mid-range values were used to calculate risks and hazards under anticipated average exposure conditions. USEPA has defined the RME as the highest exposure that can reasonably be expected to occur at a site.

Toxicity Assessment

Two types of risk estimates were prepared as part of the Baseline Risk Assessment, potential excess cancer risks (i.e., risks above the normal expected cancer rate) and non-cancer Hazard Indices (HI). The cancer risks represent estimates of the probability that an individual might develop cancer as a result of exposure over a lifetime to a chemical. For example, a 3 in 10,000 (also expressed as 3 x 10-4) risk estimate means that not more than an additional 3 out of 10,000 people exposed would be expected to develop cancer. Non-cancer health hazards are addressed by comparing average (chronic) daily intakes to reference doses. A reference dose is the amount of a chemical that a person can take in over a long term without suffering adverse health effects.

Risk Characterization

When the calculated cancer risk from lifetime exposure to site-related chemicals is estimated to be more than one additional (excess) cancer case in 10,000 (1 x 10-4), some kind of remedial action is generally required under CERCLA. When the cancer risk is between one additional cancer case in 10,000 and one in 1,000,000 (1x10-6) people, action may be necessary depending on such site-specific factors as location, environmental impact, and non-cancer health effects. If the risk is less than one additional cancer case in 1,000,000 people, action is generally not required unless there are also environmental risks or non-cancer health effects. For non-cancer effects, an HI value of 1 is considered an upper "threshold" for possible adverse health effects. The following tables summarize the cancer risks and the non-cancer hazards associated with OU2 groundwater and subsurface soil at the Site.

Summary of Cancer Risks

	Adult Resident	Child Resident	On-Site Worker	Construction Worker in Load Line 1	Construction Worker in Atlas Missile Area
Monitoring Well MW-5B	3 x 10-4	7 x 10-5	4 x 10-5	3 x 10-8	3 x 10-8
Monitoring Well MW-40B	2 x 10-3	6 x 10-4	2 x 10-4	4 x 10-6	4 x 10-6

Summary of Non-Cancer HIs
Acceptable HI range is less than 1

	Adult Resident	Child Resident	On-Site Worker	Construction Worker in Load Line	Construction Worker in Atlas Missile Area
Monitoring Well MW-5B	3	7	1	0.02	0.02
Monitoring Well MW-40B	3	13	0.9	1	1

The Baseline Risk Assessment identifies several chemicals as the principal sources of health risks. At well MW-5B, approximately 90 percent of the total cancer risk is due to RDX. Other explosives compounds (TNT and 2,4 or 2,6-dinitrotoluene (DNT)) which were also found in MW-5B, contribute an additional 9 percent to cancer risk. Virtually all of the cancer risk due to chemicals detected at well MW-40B is attributable to TCE. Similar to the case of carcinogens, non-cancer hazards for MW-5B were driven by explosives and non-cancer hazards for N4W-40B were driven by VOCs.

As discussed above, the two monitoring wells with the highest measured concentrations of TCE and RDX in groundwater were used to develop the tables presented above. Cancer risks and His calculated in an identical manner for RDX and TCE concentrations measured in other monitoring wells would be lower than these tabulated values.

Uncertainties

The procedures and inputs used to estimate risks are subject to a wide variety of uncertainties. The main sources of uncertainty identified in the OU2 risk assessment include the following:

- Environmental chemical sampling and analysis
- Estimation of exposure point concentrations
- Exposure parameter estimation
- Toxicological data

Because of these uncertainties, conservative (health-protective) assumptions have been made at each step of the risk assessment process to prevent an underestimation of site risks.

2.7.2 Ecological Risk Assessment

In the absence of a remedy, the only known potential for exposure or risk from OU2 contaminated groundwater or subsurface soil to ecological species or habitats is via irrigation. The potential for irrigation water to affect ecological species and habitats was not addressed as part of OU2, and will be evaluated in the OU3 risk assessment as part of an ongoing plant bio-uptake study.

An ecological risk assessment was performed as a part of OU1. Potential risks to the environment from contaminated soil at the site are limited to areas where high levels of contaminants have been detected. Plants and small animals exposed to high contaminant levels may experience inhibited growth or other adverse effects. Due to the localized distribution of contaminated areas, however, exposure to contaminants is not likely to cause measurable effects on plant or animal populations. Likewise, based on OU1 studies, concentrations of contaminants in on-site surface water are not likely to cause adverse effects to exposed organisms.

There may be a potential for endangered and threatened species, critical habitats, and wetlands to exist at the former NOP. The potential for endangered and threatened species, critical habitats, and wetlands to be impacted during construction and system operation will be evaluated during the Remedial Design process. The negative impacts, if any, will be mitigated or avoided. The appropriate regulatory agencies have been and will be involved in identifying endangered and threatened species, critical habitats, and wetlands.

2.8 SUMMARY OF ALTERNATIVES

Remedial Action Objectives

Remedial action objectives (RAOs) were developed to address the contaminated groundwater and explosives-contaminated soil which could act as a source of explosives contamination of groundwater while considering the long-term goals of protecting human health and the environment and meeting applicable or relevant and appropriate requirements (ARARs) of Federal and State laws and regulations. The overall OU2 RAOs are:

- Minimize the potential for ingestion of contaminated groundwater, or reduce concentrations to acceptable health-based levels

- Minimize the potential for dermal exposure to contaminated groundwater, or reduce concentrations to acceptable health-based levels

- Minimize the potential for inhalation of chemicals released during the use of contaminated groundwater, or reduce concentrations to acceptable health-based levels

The remedial action for explosives-contaminated leaching soils is to remediate those soils to the degree that the groundwater remediation potentially benefits by saving time and money, and/or increasing protectiveness.

Table 2 presents the Final Target Groundwater Cleanup Goals selected by USACE, USEPA, and NDEQ for OU2. This selection was based on balancing protection of human health and the environment with conservation of public funds consistent with the need to meet regulatory requirements including MCLs. The following rationale was used to develop the Final Target Groundwater Cleanup Goals:

- For those chemicals with MCLs established, the MCL is the cleanup goal
- For those chemicals that do not have MCLs, but have carcinogenic effects, non-carcinogenic effects, or HAs, the cleanup goal is the lowest of any of the following: the value from the carcinogenic risk of 1x10-5; the value calculated from the (non-carcinogenic) HI of 1.0; or the HAs

The plumes shown on Figure 3 delineate the area of attainment.

TABLE 2

FINAL TARGET GROUNDWATER CLEANUP GOALS

CHEMICAL OF CONCERN	CONCENTRATION (Ig/L)
Methylene chloride	5
1,2-dichloropropane	5
TCE	5
TNB	0.778
TNT	2
2,4-DNT	1.24
RDX	2

<u>Alternative Descriptions</u>

Eleven preliminary remedial action alternatives were developed during the FS to address the RAOs. Three of the alternatives were eliminated because they were determined to be ineffective. The remaining eight alternatives were evaluated in detail in the FS Report. The following sections summarize these eight alternatives, and the FS Report provides greater detail.

Certain elements were common to specific groups of the eight alternatives. To simplify the descriptions of the individual alternatives, the common elements are discussed once below instead of repeating the discussions within individual alternatives' descriptions.

Groundwater monitoring is common to all eight alternatives. Additional elements which are common to Alternatives 2 through 8 are:

- Potable water supply (point-of-entry treatment)
- Hydraulic containment
- Groundwater treatment
- Treated groundwater disposal

<u>Groundwater Monitoring</u>

The purpose of groundwater monitoring is to evaluate the changes in the distribution of the COCs and to monitor the quality of groundwater used for human consumption. Groundwater monitoring will consist of measurement of water levels, and sampling for VOCs, explosives compounds, and general water quality parameters. The exact location, number of wells, and monitoring frequency will be selected during remedial design.

<u>Potable Water Supply</u>

Groundwater treatment at the point-of-entry is included as a part of Alternatives 2 through 8. Point-of-entry treatment will provide potable water to those households with water supply wells which contain RDX exceeding the HA and/or TCE exceeding the MCL.

<u>Hydraulic Containment</u>

Hydraulic containment is a component of Alternatives 2 through 8. The goal of the hydraulic containment is to prevent groundwater outside the area of attainment from becoming contaminated in excess of the Final Target Groundwater Cleanup Goals in the future. Hydraulic containment consists of the installation and operation of a series of extraction wells to hydraulically control the movement of groundwater.

These wells will be located in the vicinity of the downgradient boundary of the area of attainment defined by the Final Target Groundwater Cleanup Goals. This is similar to the hydraulic containment component of the planned Groundwater Containment Removal Action described in Section 2.6. The difference is that the removal action hydraulic containment specifically addresses TCE contamination while the hydraulic containment component of Alternatives 2 through 8 addresses both TCE and RDX-contaminated groundwater.

Therefore, there are more extraction wells and a higher total extraction flowrate associated with the hydraulic containment component of Alternatives 2 through 8 because the area of TCE and RDX-contaminated groundwater is larger than the area of groundwater contaminated with just TCE. A total flowrate of 2,100 gallons per minute was estimated for the hydraulic containment component of Alternatives 2 through 8 so that costs could be estimated in the OU2 FS Report. The containment system wells will be completed so that groundwater is extracted from the Todd Valley aquifer and the Platte Valley alluvial aquifer. The containment system wells will not be completed in the underlying Omadi Sandstone aquifer because COC concentrations measured in that aquifer near the downgradient boundaries of the area of attainment are significantly below the Final Target Groundwater Cleanup Goal Concentrations. The final well locations and flowrates will be developed during the remedial design. If COC concentrations measured in Omadi monitoring wells located near the downgradient edges of the area of attainment equal or exceed the respective cleanup goal concentrations, additional remedial actions may be taken to contain groundwater in the upper portion of the Omadi Sandstone aquifer. The actions might include, but would not be limited to:

- Increasing the flowrate in existing extraction wells to induce upward vertical flow from the Omadi Sandstone aquifer to the extraction wells completed in the Todd Valley aquifer and/or Platte River alluvial aquifer.

- Installing and operating extraction wells which are designed to selectively extract water from the Omadi Sandstone aquifer along the downgradient edge of the respective areas of attainment.

- Installing and sampling additional monitoring wells completed in the Omadi Sandstone aquifer in conjunction with one or both of the above actions.

In addition to groundwater extraction as a part of hydraulic containment, some of the alternatives include different levels of additional groundwater extraction. The purpose of the additional extraction is to more rapidly remove contamination and shorten remediation time when compared to hydraulic containment pumping alone. The first level of additional groundwater extraction is called focused extraction and includes extraction of groundwater from areas with relatively high TCE and/or RDX concentrations. The second level of additional groundwater extraction is simply called groundwater extraction and includes extraction of groundwater throughout the area of attainment.

During the remedial design, mathematical models will be used to predict the aquifer drawdown at nearby domestic and irrigation wells. Seasonal aquifer stresses caused by irrigation and regional aquifer stresses resulting from a hypothetical drought season will be included in the analyses. The remedial design will specify how the drawdown predictions will be used as a part of an aquifer drawdown management program to help maintain the capacity of local wells to produce water at current levels. The remedial design and the groundwater monitoring program will specify the collection of water level and water quality data after the start up of the remedial extraction system. The data will be used to evaluate aquifer drawdown, and the remedial design will specify potential system operation modifications which may be enacted to effectively manage that drawdown while meeting the objectives of the remedial extraction. It may not be feasible to maintain the capacity of all local wells to produce water at current levels while maintaining the effectiveness of the hydraulic containment system. In the event remediation pumping has a negative effect on groundwater availability, the negative impacts will be evaluated and addressed by the Army. The details of determining impacts on groundwater availability and responses to the impacts will be better defined during the Remedial Design process.

Groundwater Treatment

Extracted groundwater will be pumped to a central location and treated using one of, or a combination of, the following potential treatment process options:

- GAC adsorption
- AOP
- Air stripping combined with either GAC adsorption or AOP

GAC, AOP, and air stripping will be compared before final selection of the treatment process. This selection will be made in the design analysis of the remedial design after completion of the on-going treatability studies. The selection will be based on the following factors:

- Nature and disposition of any degradation products created during treatment
- Total present worth cost
- Schedule to implement technology
- Reliability

Extracted groundwater will be treated to meet disposal dependent standards which may vary for different disposal options. The remedial design will include monitoring provisions to ensure that the disposal-dependent treatment standards are achieved. The use of one or a combination of the three potential treatment process options satisfies the statutory preference for remedies that employ treatment that reduce toxicity, mobility, or volume as a principal element.

<u>Treated Groundwater Disposal</u>

Subsequent to treatment, the water will be beneficially reused and/or discharged to a nearby stream. The selection of the treated groundwater disposal option, either surface water discharge or beneficial reuse, will be made during the remedial design analysis and will be based on the following:

- Cost/benefit analysis
- Technical feasibility
- Public acceptance

The types of beneficial reuse which may be considered include reinjection into the aquifer, agricultural use (irrigation, livestock watering, processing, or other use), and water supply (including supply to a potential rural water district, the ARDC, a nearby community or municipality, or some combination of these potential water users). A Saunders County Rural Water Project Committee has been formed to evaluate the beneficial reuse options related primarily to water supply. As a part of the committee's evaluation activities, a study is being conducted to determine the economic feasibility of constructing and operating a number of different water distribution systems. The study has been funded by a combination of local funding and matching federal funds. The study was initiated when matching funds were received from local communities, and it is estimated that the study can be completed approximately January 1997. If the study is completed in time to incorporate into the Remedial Design (approximately January 1997), the results of the study will be considered when choosing between surface water discharge and beneficial reuse during the future remedial design analysis. If not, the Army will either gather the necessary information directly, or choose not to pursue beneficial reuse.

In the OU2 FS Report, some details such as well locations and alternatives were developed for cost estimating purposes so that the various alternatives could be compared to each other. For the purposes of cost estimating, GAC adsorption was assumed to the be the selected process option for groundwater treatment during the cost analysis, and surface discharge was assumed to be the selected treated groundwater disposal option. As discussed above, these details will be addressed during the remedial design analysis.

The estimated time required to reduce the COC concentrations to the Final Target Groundwater Cleanup Goal was calculated in the same manner for each plume for Alternatives 2 through 8. The restoration time frame estimates used for the comparative cost estimates for these alternatives are assumed to be the longest of the estimates for the individual plumes. For example, the following plume restoration time frame estimates were developed for Alternative 4:

- Load Line 1 TCE plume: 31 years.
- Load Lines 2, 3, and 4 explosives plume: 77 years.
- Atlas Missile Area TCE plume: 130 years.

A restoration time was not estimated for the Load Line 1 explosives plume because analysis shows that it would always be less than the restoration time estimated for the co-located TCE plume. Based on these estimates, the part of the remedial system which extracts groundwater from the Load Line 1 plume could be turned off approximately 100 years earlier than the Atlas Missile Area extraction system. Conceptual extraction well locations and flow rates were used to develop the restoration time frame estimates as a basis for the FS cost estimate. The actual extraction well locations and flow rates wi1l be determined during remedial design. The restoration time frame assumption may potentially result in overestimation of the cost of the alternative because the extraction wells associated with the plumes that require shorter periods of time to clean up will not operate for the entire time periods presented in the descriptions of Alternatives 2 through 8.

2.8.1 Alternative 1 - No Action

This alternative was included in the FS Report as a NCP requirement to provide a baseline against which other alternatives are compared. The no-action alternative, by definition, involves no remedial action. No reduction in risks associated with potential groundwater exposure to the COCs is achieved, nor is migration of contaminants controlled. Groundwater monitoring is included to allow for ongoing evaluation of contaminant migration in the absence of remedial action. The following costs were estimated for Alternative 1:

- Estimated capital cost: $0
- Estimated annual operation and maintenance (O&M) cost: $2 million
- Sum of estimated capital and O&M present worth cost: $11 million

The present worth was calculated for all alternatives assuming a 6 percent discount rate over an 80 year period. The cost estimates are conceptual with an estimated +50 percent to -30 percent level of accuracy.

2.8.2 Alternative 2 - Hydraulic Containment

Alternative 2 includes the following previously discussed components:

- Hydraulic containment
- Groundwater treatment
- Disposal of treated groundwater
- Potable water supply
- Groundwater monitoring

An estimated total extraction flowrate of 2,100 gallons per minute and restoration time frame estimate of 970 years were used to develop the following cost estimate:

- Estimated capital cost: $8 million
- Estimated annual O&M cost: $3 million
- Sum of estimated capital and O&M present worth cost: $35 million

2.8.3 Alternative 3 - Focused Extraction

Alternative 3 includes all of the elements of Alternative 2 plus additional groundwater extraction wells which focus on areas with relatively high TCE and/or RDX concentrations. The focused extraction area will be defined during the remedial design analysis. Alternative 3 includes the following components:

- Focused extraction
- Hydraulic containment
- Groundwater treatment
- Disposal of treated groundwater
- Potable water supply
- Groundwater monitoring

It is estimated that Alternative 3 would take approximately 130 years to reduce the existing groundwater COC concentrations to the Final Target Groundwater Cleanup Goals. However, it is estimated that the leaching soils will continue contributing contamination to the groundwater for an unknown time period greater than 130 years. Therefore, the estimated restoration time frame for Alternative 3 is an unknown time period which is greater than 130 years. An estimated total extraction flowrate of 3,300 gallons per minute was used to develop the following cost estimate:

- Estimated capital cost: $13 million
- Estimated annual O&M cost: $4 million
- Sum of estimated capital and O&M present worth cost: $57 million

2.8.4 Alternative 4 - Focused Extraction and Soil Excavation

Alternative 4 includes the elements of Alternative 3 with the addition of the excavation and incineration of leaching soils. The OU1 remedial design would address both the soils that meet the OU1 excavation criteria and the OU2 leaching soils. Subsequent to the completion of the OU1 remedial design, the OU1 and OU2 soils would be excavated and incinerated together. A cost and time savings will be realized by remediating; the OU1 and OU2 soils at the same time. It is estimated that approximately 5,500 cubic yards of soil meet the OU1 excavation criteria, and that the volume of OU2 leaching soils is approximately 2,600 cubic yards. Therefore, the total volume of soil to be excavated and incinerated is estimated as 8,100 cubic yards. The OU2 leaching soils are shown on Figures 4 through 7.

Alternative 4 includes the following components:

- Soil excavation and incineration
- Focused extraction
- Hydraulic containment
- Groundwater treatment
- Disposal of treated groundwater
- Potable water supply
- Groundwater monitoring

An estimated total extraction flowrate of 3,300 gallons per minute and restoration time frame estimate of 130 years were used to develop the following cost estimate:

- Estimated capital cost: $17 million
- Estimated annual O&M cost: $4 million
- Sum of estimated capital and O&M present worth cost: $61 million

2.8.5 Alternative 5 - Focused Extraction with Air Sparging

Alternative 5 includes the elements of Alternative 2 with the addition of focused groundwater extraction wells and air sparging. The air sparging system will be located in the Atlas Missile Area TCE plume where there are relatively high groundwater concentrations of TCE without the presence of explosives. Air sparging is an emerging technology which removes VOCs such as TCE from the groundwater without extracting the groundwater. This is accomplished by drilling wells in the aquifer to inject air into the contaminated groundwater. The air moves up through the groundwater, and some of the TCE transfers from the groundwater to the migrating air. The organic vapors which exit the saturated zone are collected below the ground surface by a SVE system and treated if necessary. This technology is not effective at removing explosives and is only proposed for areas of TCE-contaminated groundwater. Therefore, the focused extraction wells would be installed in areas where RDX concentrations or TCE and RDX concentrations are relatively high. Alternative 5 includes the following components:

- Air sparging
- Focused extraction
- Hydraulic containment
- Groundwater treatment
- Disposal of treated groundwater
- Potable water supply
- Groundwater monitoring

It is estimated that Alternative 5 would take approximately 110 years to reduce the existing groundwater COC concentrations to the Final Target Groundwater Cleanup Goals. However, it is estimated that the leaching soils will continue contributing contamination to the groundwater for an unknown time period greater than 110 years. Therefore, the estimated restoration time frame for Alternative 5 is an unknown time period which is greater than 110 years. An estimated total extraction flowrate of 2,770 gallons per minute was used to develop the following cost estimate:

- Estimated capital cost: $32 million
- Estimated annual O&M cost: $4 million
- Sum of estimated capital and O&M present worth cost: $76 million

2.8.6 Alternative 6 - Focused Extraction with Air Sparging and Soil Excavation

Alternative 6 includes the elements of Alternative 5 with the addition of the excavation and incineration of leaching soils which was described for Alternative 4.

Alternative 6 includes the following components:

- Soil excavation and incineration
- Air sparging
- Focused extraction
- Hydraulic containment
- Groundwater treatment
- Disposal of treated groundwater
- Potable water supply
- Groundwater monitoring

An estimated total extraction flowrate of 2,770 gallons per minute and restoration time frame estimate of 110 years were used to develop the following cost estimate:

- Estimated capital cost: $36 million
- Estimated annual O&M cost: $4 million
- Sum of estimated capital and O&M present worth cost: $81 million

2.8.7 Alternative 7 - Groundwater Extraction

Alternative 7 includes all of the elements of Alternative 2 plus additional groundwater extraction wells to extract contaminated groundwater throughout the contaminated areas. Alternative 7 includes the following components:

- Groundwater extraction
- Hydraulic containment
- Groundwater treatment
- Disposal of treated groundwater
- Potable water supply
- Groundwater monitoring

It is estimated that Alternative 7 would take approximately 90 years to reduce the existing groundwater COC concentrations to the Final Target Groundwater Cleanup Goals. However, it is estimated that the leaching soils will continue contributing contamination to the groundwater for an unknown time period greater than 90 years. Therefore, the estimated restoration time frame for Alternative 7 is an unknown time period which is greater than 90 years. An estimated total extraction flowrate of 4,200 gallons per minute was used to develop the following cost estimate:

- Estimated capital cost: $15 million
- Estimated annual O&M cost: $4 million
- Sum of estimated capital and O&M present worth cost: $62 million

2.8.8 Alternative 8 - Groundwater Extraction and Soil Excavation

Alternative 8 includes the elements of Alternative 7 with the addition of the excavation and incineration of leaching soils which was described for Alternative 4.

Alternative 8 includes the following components:

- Soil excavation and incineration
- Groundwater extraction
- Hydraulic containment
- Groundwater treatment
- Disposal of treated groundwater
- Potable water supply
- Groundwater monitoring

An estimated total extraction flowrate of 4,200 gallons per minute and restoration time frame estimate of 90 years were used to develop the following cost estimate:

- Estimated capital cost: $19 million
- Estimated annual O&M cost: $4 million
- Sum of estimated capital and O&M present worth cost: $66 million

2.9 TREATABILITY STUDIES

On-going treatability studies are being performed to provide performance data needed to evaluate the potential feasibility of technologies for treating the COCs. The bench-scale treatability studies focus on RDX and TCE which are two major site contaminants. The primary objectives of the studies are to:

- Develop Freundlich adsorption isotherm constants for TCE and RDX in former NOP site groundwater using GAC

- Assess the efficiency of selected AOP technologies to treat former NOP site groundwater

The results of the GAC isotherm tests will be used to refine the literature-based GAC usage rate used to estimate costs in the FS. The AOP test results will be used to evaluate whether oxidation technologies are effective in removing contaminants detected in former NOP site groundwater. If the AOP or the GAC processes are successful, the results may be used to design on-site pilot studies. Details of the treatability studies are presented in the Groundwater Treatability Study Work Plan.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

2.10.1 Introduction

USEPA has established nine criteria that balance health, technical, and cost considerations to determine the most appropriate remedial action alternative. These criteria are used to select a remedial action that is protective of human health and the environment, attains ARARs, is cost effective, and utilizes permanent solutions and treatment technologies to the maximum extent practicable. The remedial action alternatives developed in the FS have been evaluated and compared using the nine criteria set forth under NCP 300.430(e)(9)(iii). These nine criteria are summarized as follows:

1. OVERALL PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT addresses whether a remedial action provides protection of human health and the environment and describes how risks which are posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) addresses whether a remedial action will meet all applicable or relevant and appropriate requirements of Federal and State laws and regulations and/or provides grounds for invoking a waiver.

3. LONG-TERM EFFECTIVENESS AND PERMANENCE refers to the ability of a remedial action to maintain reliable protection of human health and the environment over time, after RAOs have been met.

4. REDUCTION OF CONTAMINANT TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT addresses the anticipated, performance of the treatment technologies that a remedial action employs.

5. SHORT-TERM EFFECTIVENESS addresses the period of time needed to achieve protection from adverse impacts on human health and the environment that may be posed during the construction and implementation period, until RAOs are achieved.

6. IMPLEMENTABILITY is the technical and administrative feasibility of a remedial action, including the availability of materials and services needed to implement a particular option.

7. COST includes estimated initial capital, O&M costs, and present worth costs.

8. STATE ACCEPTANCE indicates whether the state agency concurs with, opposes, or has no comment on the preferred remedial action alternative at the present time.

9. COMMUNITY ACCEPTANCE is based on comments received from the public during the public comment period. These comments are assessed in the Responsiveness Summary included with this ROD.

2.10.2 Comparison of Alternatives

Alternatives were compared in the FS with respect to the nine evaluation criteria. This comparison is discussed below. For the purpose of this discussion, the evaluation criteria have been divided into three groups (threshold, balancing, and modifying criteria) based on the function of each criterion during remedial action evaluation and selection.

A. Threshold Criteria

Threshold criteria are statutory requirements that must be satisfied by a remedial action alternative in order for it to be eligible for further detailed evaluation in the FS and subsequent selection. These two criteria are discussed below.

Overall Protection of Human Health and the Environment

Alternative 1 (no action) would not have satisfied the requirement for overall protection of human health and the environment. Estimated risks remaining with the no action alternative would have been the same as those identified in the Baseline Risk Assessment. Because Alternative 1 does not meet the threshold criteria, it is not evaluated under the remaining criteria.

Alternatives 4, 6, and 8 provide the highest degree of overall protection of human health and the environment because the alternatives address contaminants in both groundwater and soil.

Alternatives 2 through 8 use point-of-entry systems and groundwater extraction to protect potential future groundwater users.

Alternatives 2 through 8 provide environmental protection by containing contaminated groundwater and minimizing its potential for migration past the area of attainment. These alternatives also reduce contaminant concentrations; by groundwater treatment. The potential for contaminated soils to be a continuing source of groundwater contamination will be reduced by soil excavation and treatment in Alternatives 4, 6, and 8 thereby providing additional protection of human health and the environment.

Compliance with ARARs

Alternatives 2 though 8 would comply with ARARs although Alternative 2 would require a very long time to do so.

B. Balancing Criteria

Five balancing criteria are used to identify major trade-offs between the remedial action alternatives which satisfy the two threshold criteria. These tradeoffs are ultimately used to identify the preferred alternative and to select the final remedy.

Long-Term Effectiveness and Permanence

Alternatives 2 through 8 control long-term risk by point-of-entry groundwater treatment systems for impacted residences, and downgradient groundwater users are protected by hydraulic containment. Long-term risk is further reduced in Alternatives 3 and 8 by groundwater extraction wells (in addition to the containment system). Soil treatment associated with Alternatives 4, 6, and 8 reduces the potential for long-term risk associated with the transfer of contaminants from the soil to the groundwater. The sum of the excess cancer risks calculated using each Final Target Groundwater Cleanup Goal concentration is 2x10-5. This aggregate risk is estimated to be the maximum value of the residual risk associated with groundwater at the completion of remediation.

The point-of-entry treatment systems associated with Alternatives 2 through 8 are reliable and adequate to treat the COCs. Hydraulic containment and other extraction systems which are a part of Alternatives 2 through 8 are reliable. Air sparging (Alternatives 5 and 6) is an emerging technology, and reliability and adequacy must also be monitored. Long-term engineering controls are not necessary for the soil treatment included as a part of Alternatives 4, 6, and 8.

Alternatives 2 through 8 will require periodic evaluations or reviews to ensure that the remedial action objectives are being met and human health and the environment are being protected. The effectiveness of the remedy will be periodically evaluated on a frequent basis beginning shortly after implementation. After the initial implementation period, the frequency of review will be reduced, however, reviews will continue to be conducted no less than once every five years until the remedial action objectives are achieved.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 2 through 8 will eventually clean up all groundwater contamination, although the rate at which the groundwater is cleaned up will vary between alternatives. For example, it is estimated that Alternative 2 would take a very long time, almost 1,000 years, to clean up the groundwater while Alternative 4 is estimated to take 130 Years. Explosives contamination in approximately 2,600 cubic yards of soil will be destroyed as a part of Alternatives 4, 6, and 8.

Alternatives 2 through 8 will reduce toxicity and volume of contaminated groundwater. The rate at which the volume of contaminated water is removed is proportional to the total extraction flowrate. The following list ranks the alternatives in terms of decreasing total extraction flow rate. The flow rates were used to estimate costs in the FS Report.

- Alternatives 7 and 8 (4,200 gallons per minute or gpm)
- Alternatives 3 and 4 (3,300 gpm)
- Alternatives 5 and 6 (2,770 gpm)
- Alternative 2 (2,100 gpm)

For Alternatives 2 through 8, the groundwater contaminants remain mobile but the mobility (potential for migration) is managed through containment. The incineration of explosives-contaminated soils, which is an element of Alternatives 4, 6, and 8; reduces toxicity, mobility, and volume of the explosive contaminants in the soils through treatment and reduces the potential threat of groundwater contamination.

The treatment technologies being considered for soil and/or groundwater as a part of Alternatives 2 through 8 destroy the contaminants and are therefore irreversible. Residual materials resulting from the treatment of groundwater as a part of Alternatives 2 through 8 may include spent carbon from both groundwater and/or off-gas treatment. Residual materials from soil incineration (Alternatives 4, 6, and 8) may include scrubber water and/or ash. The quantities of all residual materials for Alternatives 2 through 8 are manageable and do not pose residual risk when properly managed.

Alternatives 2 through 8 satisfy the statutory preference for treatment.

Short-Term Effectiveness

In terms of adverse environmental impacts, aquifer drawdown associated with the extraction of groundwater during Alternatives 2 through 8 may reduce the amount of groundwater available for aquifer users. The potential for groundwater drawdown to adversely impact groundwater users is related to the extraction flowrates. Therefore, the highest potential for adverse environmental impacts is associated with Alternatives 7 and 8, and the lowest potential is associated with Alternative 2.

Risks to the community are not increased by the implementation of the groundwater remedies which are included as elements of Alternative 2 through 8. For Alternatives 4, 6, and 8, there is potential for exposure due to explosives-contaminated dust during soil excavation, transportation, stockpiling and incineration. The potential for fugitive dust emissions during excavation, transportation, and stockpiling can be managed using standard construction dust control practices such as the application of water, other dust suppressants, and the use of tarps.

OU1 and OU2 soils will be treated at the same time using the same incinerator. The incinerator will be operated at a 99.99 percent destruction and removal efficiency (DRE). The DRE is a measurement of the effectiveness of the combustion process in an incinerator. The 99.99 percent DRE requirement applied to the principal contaminants, explosives compounds, will prevent unacceptable exposure to the principal contaminants. Metals (which naturally occur in soil) associated with airborne particulates will be managed by the incinerator air pollution control system. All adverse health risks associated with the incineration process are manageable.

There are relatively low risks to construction workers beyond the general construction safety issues during the implementation of the groundwater remedies which are included as elements of Alternative 2 through 8. For Alternatives 4, 6, and 8, there is potential for ingestion or inhalation of airborne material during excavation and transportation of contaminated soil. Such emissions can be controlled as discussed above.

There are relatively small adverse environmental impacts associated with the implementation of the groundwater remedies associated with Alternatives 2 through 8. Operation of groundwater remediation systems will lower the water table to varying degrees at different locations. The potential aquifer drawdown at existing water supply wells (primarily domestic, irrigation, and stock wells) which may result from groundwater extraction could not be quantified during the FS because the extraction well locations and pumping rates will be selected during the remedial design. The remedial design will minimize groundwater drawdown at existing water supply wells while balancing effectiveness and technical feasibility. The excavation and treatment of contaminated soils as a part of Alternatives 4, 6, and 8 will have a beneficial environmental impact because the potential for continuing contribution to groundwater contamination will be reduced.

The point-of-entry treatment system associated with Alternatives 2 through 8 will be immediately available. Alternatives 2 through 8 are listed below in order of increasing restoration time frame estimates:

- Alternative 8 (90 years)
- Alternative 6 (110 years)
- Alternative 4 (130 years)
- Alternative 3 (greater than 130 years), Alternative 5 (greater than 110 years), and Alternative 7 (greater than 90 years)
- Alternative 2 (970 years)

Alternatives 3, 5, and 7 are listed in the same bullet because it is expected that the release of explosives from leaching soils to the groundwater will last approximately the same period of time for these alternatives which do not include leaching soils clean up. This time is not known, but it is expected to be a finite time greater than 130 years.

Please remember that the time frame estimates listed above are the longest individual plume restoration time frame calculated for each alternative. The restoration time frame estimates are shorter for the other plumes.

<u>Implementability</u>

Carbon adsorption, air stripping, and advanced oxidation treatment technologies are being considered for the treatment of extracted groundwater as a part of Alternatives 2 through 8. Advanced oxidation is an emerging treatment technology. The air sparging element of Alternatives 5 and 6 is also an emerging technology. Incineration of explosives-contaminated soil (Alternatives 4, 6, and 8) is a proven and effective treatment process.

Alternatives 2 through 8 possess the same degree of implementability with the exception of Alternatives 5 and 6 which rely on air sparging, an emerging technology. The emerging technology status means that the alternatives may be more difficult to implement.

The groundwater treatment system elements of Alternatives 2 through 8 can be constructed and operated using common practices. As discussed earlier, advanced oxidation treatment processes are emerging technologies. The air sparging element of Alternatives 5 and 6 may require specialized drilling procedures. The incineration of soils which is included as a part of Alternatives 4, 6, and 8 is a highly technical process but is commonly used and has demonstrated effectiveness.

Additional point-of-entry treatment systems and additional extraction wells can easily be added to Alternatives 2 through 8. The groundwater treatment system for those alternatives can be designed to allow for varying volumes and concentrations of groundwater. Additional capacity can be added with relative ease to the air sparging system which is an element of Alternatives 5 and 6. There is no need for expansion of the soil treatment system included as a part of Alternatives 4, 6, and 8.

Groundwater monitoring and the proposed treatment system would provide notice of potential failure of the groundwater extraction systems which are a part of Alternatives 2 through 8, and the air sparging system component of Alternatives 5 and 6. The soil treatment system of Alternatives 4, 6, and 8 will require emissions monitoring during implementation.

There is no anticipated difficulty in obtaining approvals and coordination with USEPA and NDEQ for the groundwater treatment elements of Alternatives 2 through 8. Alternatives 4, 6, and 8 include soil incineration which will include a test of the treatment process called a trial burn prior to implementation of the OU1 remedy.

All services are available for the groundwater treatment elements of Alternatives 2 through 8, although the air sparging element of Alternatives 5 and 6 is an emerging technology. All services are available for the soil treatment element of Alternatives 4, 6, and 8.

All materials, equipment, and specialists are available for Alternatives 2 through 8, although the air sparging element of Alternatives 5 and 6 is an emerging technology.

All technologies are available for Alternatives 2 through 8, although the air sparging element of Alternatives 5 and 6 is an emerging technology.

Cost

The alternatives are listed below in order of increasing estimated capital costs:

- Alternative 2 ($8 million)
- Alternative 3 ($13 million)
- Alternative 7 ($15 million)
- Alternative 4 ($17 million)
- Alternative 8 ($19 million)
- Alternative 5 ($32 million)
- Alternative 6 ($36 million)

The annual operation and maintenance costs are estimated to be approximately $3 million for Alternative 2. The annual operation and maintenance costs for Alternatives 3 through 8 are estimated to be approximately $4 million.

The alternatives are listed in order of increasing sum of capital cost and present worth costs of the operation and maintenance costs:

- Alternative 2 ($35 million)
- Alternative 3 ($57 million)
- Alternative 4 ($61 million)
- Alternative 7 ($62 million)
- Alternative 8 ($66 million)
- Alternative 5 ($76 million)
- Alternative 6 ($81 million)

C. Modifying Criteria

The two modifying criteria were evaluated following comment on the proposed plan and are addressed as the final decision is made and the ROD is prepared. The results of the modifying criteria are summarized below.

State Acceptance

This assessment evaluates technical and administrative issues and concerns NDEQ may have regarding each of the alternatives. NDEQ has been actively involved in the entire RI/FS process leading to the development of this ROD, including being party to the IAG, participating in all TRC, IAG Project Managers, and public meetings, oversight of field work, and review and comment on all draft project documents.

Community Acceptance

Public comments on the selected remedial action were presented at the public meeting on November 8, 1995. Eight written comments were received during the comment period which extended from October 30, 1995 to November 29, 1995

In general, the public had differing opinions regarding Alternative 4 as the preferred alternative. Four written comments supported Alternative 4, and three written comments neither supported nor opposed the use of Alternative 4. One written comment opposed any pump and treat alternative. A summary of public comments and USEPA/USACE responses are provided in the Responsiveness Summary, Section 3.0 of this document.

2.10.3 Summary

Based on the nine evaluation criteria, Alternative 1 would not have provided protection from the potential site risks and would not have complied with the ARARs. Therefore, it does not meet the threshold criteria for selection of a remedial action alternative for this site.

If it had been selected, Alternative 2 would have controlled long-term risk using point-of-entry groundwater treatment systems at impacted residences, and downgradient groundwater users would have been protected by the element of hydraulic containment. However, it is estimated that Alternative 2 would take a very long time, almost 1,000 years, to clean up all of the groundwater.

If Alternative 3 had been selected, it would have controlled long-term risk in a manner similar to Alternative 2, plus Alternative 3 would have provided additional protection through the element of focused extraction. The focused extraction would have extracted groundwater from areas with relatively high concentrations of TCE and/or RDX. Alternative 3 would have potentially reached the Final Target Groundwater Cleanup Goals at an earlier date relative to Alternative 2. However, Alternative 3 does not reduce the potential for transfer of explosives from the soil to the groundwater.

Alternative 4 will be protective of human health and the environment and will attain the ARARs using proven technologies. Leaching soils excavation and treatment will remove a potential source of groundwater contamination. Focused extraction will shorten the restoration time while causing less adverse impact on groundwater availability when compared to Alternatives 7 and 8.

If Alternative 5 had been selected, it would have controlled long-term risk in a manner similar to Alternative 3 except that Alternative 5 would have included air sparging, an emerging technology.

If Alternative 6 had been selected, it would have controlled long-term risk in a manner similar to Alternative 4 except that Alternative 6 would have included air sparging, an emerging technology, at a higher capital and annual O&M cost.

If Alternative 7 had been selected, it would have controlled long-term risk in a manner similar to Alternative 2 plus Alternative 7 would have provided additional protection through the element of groundwater extraction. The groundwater extraction would have extracted groundwater throughout the area of contamination. Alternative 7 would have potentially reached the Final Target Groundwater Cleanup Goals in the shortest time period with the exception of Alternative 8. However, Alternatives 7 and 8 would have extracted groundwater at the highest rate thereby creating the greatest potential for water availability conflicts with other groundwater users.

If Alternative 8 had been selected, it would have provided all of the Alternative 7 controls. In addition, Alternative 8 would have reduced the potential for transfer of explosives from the soil to the groundwater.

2.11 THE SELECTED REMEDIAL ACTION

Alternative 4 was selected because it will be protective of human health and the environment, will comply with ARARs, will utilize permanent solutions to the maximum extent practicable, will significantly reduce the toxicity, mobility, and volume of contaminants through treatment, and is implementable. This alternative satisfies the RAOs for this remedial action discussed in Section 2.8.

Alternative 4 provides the best balance of tradeoffs among the alternatives, with respect to the evaluation criteria, especially the five balancing criteria. Alternative 4 was distinguished from the other alternatives by the inclusion of both leaching soils excavation and treatment, and focused extraction of groundwater. The soils excavation and treatment will remove a potential source of groundwater contamination. The focused extraction will shorten the restoration time with the least adverse impact on groundwater availability.

The major components of the selected remedial action for OU2 include:

- Hydraulically contain contaminated groundwater exceeding the Final Target Groundwater Cleanup Goals.

- Focused extraction of groundwater in areas with relatively high concentrations of TCE and explosives.

- Treat all extracted groundwater using GAC adsorption, AOP, and air stripping, any of which may be applied individually or in combination.

- Dispose of the treated groundwater by beneficially reusing it or through surface discharge.

- Provide a potable water supply to local groundwater users whose water supply contains RDX exceeding the HA and/or TCE exceeding the MCL

- Monitor the groundwater elevations and water quality.

- Excavate and treat explosives-contaminated soil which could act as a source of explosives contamination of groundwater and which does not meet the Operable Unit 1 (OU1) excavation criteria.

Alternative 4 will reduce the groundwater contaminants within the area of attainment shown on Figure 3 to concentrations at, or below, the Final Target Groundwater Cleanup Goals listed in Table 2. The residual risk will be less than or equal to the aggregate risk of 2x10-5.

2.12 STATUTORY DETERMINATIONS

CERCLA Section 121(d) requires that the selected remedy comply with all federal and state environmental laws that are applicable or relevant and appropriate to the hazardous substances, pollutants, or contaminants at the site or to the activities to be performed at the site. Therefore, to be selected as the remedy, an alternative must meet all ARARs or a waiver must be obtained. A discussion of how each ARAR applies to the selected OU2 remedial actions is provided in the following paragraphs.

2.12.1 Protection of Human Health and the Environment

The selected remedial action will protect human health and the environment through provision of a potable water supply, hydraulic containment and focused extraction of contaminated groundwater, and subsequent treatment and disposal of the extracted groundwater. This will eliminate the groundwater pathways through which contaminants pose risks. In addition, the potential for transfer of explosives from the soil to the groundwater will be reduced by excavation and incineration of selected soils.

2.12.2 Compliance with ARARs

The selected remedy will be designed to comply with all Federal and State ARARs. A list of ARARs pertinent to the site can be found in Table 3. The ARARs that will be achieved by the selected remedy are:

<u>FEDERAL</u>

Clean Air Act of 1963, as amended (42 U.S.C. °°7401-7642)

40 CFR Parts 50 and 61

This regulation is pertinent to excavation, materials handling activities, and emissions from an air stripper (if included for treatment of VOC-contaminated groundwater) which may result in fugitive air emissions. Control measures, including water or other dust suppressants, truck tarpaulins, covers for soil stockpiles, and temporary structures for the treatment process train will be used to minimize the potential for air emissions. Thermal treatment emissions are also of concern. The air pollution control system for the incinerator will be designed to meet appropriate Clean Air Act requirements.

Clean Water Act of 1977, as amended (33 U.S.C. °°1251-1376)

40 CFR Part 122, 125

The National Pollutant Discharge Elimination System (NPDES) was established to control discharge of pollutants from any point source into waters of the United States. A permit will not be required since the site is being remediated as part of the Superfund program; however, the substantive requirements of the regulation must be met. This regulation applies to the discharge of treated groundwater to surface water on or near the site; decontamination fluids discharged to the ground, surface water, or treated on-site prior to discharge to the ground or surface water; and process water. Process water may be recycled to quench the ash, sprayed on-site for dust control, discharged to the ground or a nearby surface water body, or treated off-site.

Discharge limits for the COCs will be established during remedial design and will be consistent with the requirements of the NPDES program. If established surface water discharge limits are not met, provisions for alternate effluent limits can be found in this part.

40 CFR Part 122.2b

Stormwater runoff must be monitored and controlled on construction sites greater than five acres. This part will apply during the implementation of the remedy in areas of soil excavation, stockpiling, and preparation for incineration.

40 CFR Part 131

States must establish ambient water quality criteria for the protection of surface water based on use classifications and the criteria stated under Section 304(a) of the Clean Water Act. These criteria are applicable and will be used to establish discharge limits for treated groundwater, decontamination fluids, or process water.

40 CFR Part 136.1-5 and Appendices 1-C

Analytical methods specified in this part will be used to analyze samples pursuant to NPDES requirements. Applicable reporting procedures and formats will be used.

Safe Drinking Water Act of 1986, as amended (40 U.S.C. º300)

40 CER Part 141

Primary Drinking Water Standards are established by this part. MCLs are health-based standards for public water supplies. The discharge of treated groundwater, decontamination fluids, or process water will not directly impact drinking water; however, the potential for residual contaminants percolating to groundwater exists. The NCP requires consideration of MCLs, where they exist, as relevant and appropriate to groundwater cleanup standards when the aquifer is a current or potential source of drinking water. MCLs for COCs, where established, are relevant and appropriate for establishing discharge limits to be met during implementation of the remedy.

40 CFR Part 143

Secondary Drinking Water Standards (SMCLs) are criteria applied to ensure the aesthetic quality of drinking water (color, taste, and odor). These standards will be considered during the evaluation of disposal options for treated water.

Resource Conservation and Recovery Act (RCRA) of 1976, as amended (42 U.S.C. ºº6901-6987)

40 CFR Part 261

The criteria set forth in this part will be used to determine if soils, treatment residuals, or other solid wastes excavated, created through treatment, or otherwise generated during the implementation of the remedy are hazardous or non-hazardous. The goal is to incinerate excavated soil until it is no longer hazardous.

The soils (ash) remaining after incineration will be tested and compared to the criteria for determining if a solid waste is hazardous so that the appropriate final disposition can be made. If the ash is hazardous due to the presence of metals, then off-site disposal and/or treatment at an approved hazardous waste management facility will be included in the remedy. If the ash is not hazardous, the waste will be disposed off-site.

Scrubber blowdown or vapor phase granular activated carbon may be generated as part of the control of air emissions from the incinerator. Spent GAC, if used to treat groundwater, will be generated. These treatment residuals will be assessed and managed in accordance with 40 CFR Part 261.

40 CFR Part 262.11

The methods for determining whether a solid waste is hazardous are set forth in this part. All generators of solid wastes are required to determine if a waste is hazardous. Wastes determined to be hazardous will be managed in accordance with the rules applicable to hazardous wastes.

40 CFR Part 262.34

The accumulation of hazardous waste on-site is addressed by this part. In the event any of the soils, treatment residuals, or other solid waste excavated, created through treatment, or otherwise generated during the implementation of the remedy are hazardous, these regulations will be applied.

40 CFR Part 263

Any solid waste generated on-site, determined to be a hazardous waste per Part 261, and to be removed from the site for disposal must be transported in accordance with the requirements of this part. The requirements provide standards for transporters of hazardous waste. Transporters used during the remedy must comply with this part.

40 CFR Part 264

This part establishes minimum national standards defining the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste. The regulations of this part pertaining to incineration of soil and management of treatment residuals determined to be hazardous are applicable or relevant and appropriate. RCRA requirements are applicable to any treatment residuals which are TCLP toxic and will be removed from the site. RCRA requirements are applicable for any treatment residuals which are TCLP toxic.

The technical requirements for incinerators (Subpart O) are relevant and appropriate to the incineration of soil included in the remedy.

Subpart S of part 264 addresses corrective action at solid waste management units. Requirements for corrective action management units (CAMUs) and temporary units (TUs) for management of remediation wastes are specified. This part will govern the excavation and stockpiling of soil for incineration.

40 CFR Part 264.30-56

Preparedness, prevention, and contingency planning for hazardous waste facilities is discussed in this part. In the event any of the soils, treatment residuals, or other solid waste excavated, created through treatment, or otherwise generated during the implementation of the remedy are hazardous, these regulations will be applied.

Hazardous Materials Transportation Act (Chapter 81, Article 15)

42 CFR Part 107

Hazardous materials removed from the site for disposal or treatment will need to be transported in accordance with the regulations of this part.

49 CFR Part 171

This part contains packaging, marking, and other requirements related to the transportation of hazardous materials. In the event any of the soils, treatment residuals, or other solid waste excavated, created through treatment, or otherwise generated during the implementation of the remedy determined to be hazardous are removed from the site, these regulations will be applied.

49 CFR Part 172

Tables of hazardous materials and shipping requirements for same are provided in this part. In the event any of the soils, treatment residuals, or other solid waste excavated, created through treatment, or otherwise generated during the implementation of the remedy determined to be hazardous are removed from the site, these regulations will be applied.

STATE

Nebraska Environmental Protection Act (Revised Statutes of Nebraska, Chapter 81)

This chapter establishes the state's policy on environmental control.

Nebraska Air Pollution Control Rules and Regulations (Title 129)

Chapter 2.5, 17

The definition of a "major source" of air pollution is established in Chapter 2. Chapters 5 and 17 define the appropriate permit requirements for operation, construction, or modification of a source of air emissions. The incinerator will be evaluated in accordance with Chapter 2 to verify that it is not a major source; however, the substantive requirements for a permit, contained in Chapters 5 and 17, must be met.

Chapter 4

This chapter specifies primary and secondary ambient air quality standards for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, and lead. Standards established in this chapter will be considered during the design of the incinerator.

Chapter 16

This chapter sets forth the best engineering practices for incinerator stack height design. The recommended procedures for stack height design will be followed during the design of the incinerator.

Chapter 19

40 CFR 52.21, Prevention of Significant Deterioration of Air Quality, is adopted. This chapter would prevent the operation of an incinerator without appropriate measures to control potentially detrimental air emissions. The incinerator included in the remedy will have the appropriate pollution controls to prevent significant deterioration of air quality.

Chapter 20

This chapter prohibits visible dust beyond the limits of the property line where handling, transportation, or construction is taking place. Dust control measures will be applied during soil excavation, stockpiling, and feeding into the incinerator to prevent visible emissions beyond the former NOP site boundaries.

Chapter 22

Emission limits for new incinerators are specified along with the outline and content required for emission control reports. The emission limits for new incinerators will be considered during design of the incinerator.

Chapter 39

This chapter limits visible emissions from diesel-powered construction equipment or vehicles. Equipment used on-site for excavation, stockpiling, or transportation will comply with these limits.

Rules and Regulations Pertaining to the Management of Wastes (Title 126, NDEQ)

This statute requires permits or licenses for various state management activities and establishes policy for releases of oil or hazardous substances.

Water Quality Standards for Surface Waters of the State (Title 117)

Water quality standards for surface waters of the state. Similar to ambient water quality, these criteria are applicable and will be used to establish discharge limits for treated groundwater, decontamination fluids, or process water.

Groundwater Quality Standards and Use Classification (Title 118, NDEQ)

This statute specifies standards and use classifications for groundwater used as drinking water and is used by the State of Nebraska to establish priorities for groundwater remedial actions. The selection and design of the remedy is based on the use of groundwater at the former NOP as a drinking water source.

National Pollutant Discharge Elimination System (NPDES) (Title 119, NDEQ)

This statute establishes the requirements for permitting a point source discharge to waters of the state. As is the case for the federal NPDES program, no permit is required because of the site's Superfund status. However, the substantive requirements of a permit must be met. Discharge limits will be established during remedial design and compliance with these values will be demonstrated in accordance with NPDES requirements.

Nebraska General NPDES Rules for New and Existing Sources (Title 121, NDEQ)

The effluent standards set forth in this statute will be used in developing discharge limits for the groundwater treatment system, decontamination fluids, or process water.

Rules and Regulations Governing Hazardous Waste Management in Nebraska (Title 128, NDEQ)

The procedures specified in this statute will be used to notify the appropriate state authorities of the activities at the site, including the construction of the incinerator.

Regulations Governing Licensure of Water Well and Pump Installation Contractors and Certification of Water Well Drilling and Pump Installation, and Water Well Monitoring Supervisors (Nebraska Administrative Code, Title 178, Nebraska Department of Health, Chapter 12)

Contractors installing extraction wells, pumps, and/or monitoring wells at the site will be licensed in accordance with Title 178 of the Nebraska Administrative Code.

Regulations Governing Water Well Construction, Pump Installation, and Water Well Abandonment Standards (Nebraska Administrative Code, Title 178, Nebraska Department of Health, Chapter 12)

Extraction wells and pumps will be installed and registered in accordance with the requirements of Title 178 of the Nebraska Administrative Code. Any future abandonment of wells (including existing monitoring wells not included in the long-term monitoring network) will comply with these regulations.

Nebraska Drinking Water Standards (Nebraska Administrative Code, Title 179, Department of Health)

State MCLs are established by this regulation. The discharge of treated groundwater, decontamination fluids, or process water will not directly impact drinking water; however, the potential for residual contaminants percolating to groundwater exists. State MCLs for COCs, where established will be considered when establishing discharge limits for treated water.

<u>TO BE CONSIDERED STANDARDS (TBCs)</u>

Lifetime Health Advisories (HAs)

Lifetime Health Advisories are drinking water criteria designed to protect human health and include a margin of safety. The numerical standards are TBCs and do not have the status of potential ARARs. The lifetime HA for both TNT and RDX is 2 Ig/l. These criteria will be considered when establishing effluent discharge criteria for treated groundwater.

Drinking Water Equivalent Levels (DWELs)

Drinking Water Equivalent Levels (DWELs) are health-based drinking water criteria designed to protect against adverse non-cancer effects. The DWEL for methylene chloride is 2000 Ig/L and for TCE is 300 Ig/L. For TNT, the DWEL is 20 Ig/L. The DWEL for both 2,4-DNT and RDX is 100 Ig/L. These criteria are TBCs for the site and will be considered when establishing effluent discharge criteria for treated groundwater.

2.12.3 Cost Effectiveness

The selected remedial action is cost-effective because it provides overall effectiveness proportional to its costs. The estimated costs of the selected remedy are the lowest for any alternative which controls long-term risk to groundwater consumers and reduces the potential for transfer of explosives from the soil to the groundwater. The selected remedy will be effective in the long-term due to the significant and permanent reduction of the toxicity, mobility, and volume of contaminated groundwater.

2.12.4 Utilization of Permanent Solutions and Innovative Treatment Technologies to the Maximum Extent Practicable

SARA specifies a preference for use of permanent solutions and innovative treatment technologies or resource recovery technologies to the maximum extent practicable. The selected remedial action utilizes a permanent solution but not an innovative treatment technology. Of those alternatives that comply with the threshold criteria, USACE, USEPA, and NDEQ have determined that the selected alternative provides the best balance in terms of long-tem effectiveness and permanence, reduction of toxicity, mobility, and volume through treatment, short-term effectiveness, and cost.

2.12.5 Preference for Treatment Which Reduces Toxicity, Mobility, or Volume

By hydraulically containing and extracting groundwater containing COCs greater than the Final Target Groundwater Cleanup Goals, the selected remedial action addresses one of the principal threats posed by the former NOP site. The selected remedy also satisfies the statutory preference for remedial actions that employ treatment to significantly reduce toxicity, mobility, or volume of contaminants in groundwater and soil.

2.13 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy has not been significantly changed from the preferred remedy presented in the OU2 Proposed Plan.

3.0 RESPONSIVENESS SUMMARY

In October 1995, USEPA and USACE released the Proposed Plan for the former NOP site, OU2, i.e., contaminated groundwater, explosives-contaminated soil not remediated during OU1 which could act as a source of explosives contamination of groundwater, and soil contaminated with VOCs. The public comment period for the Proposed Plan lasted from October 30, 1995 to November 29, 1995. The USEPA and the USACE sponsored a public meeting on November 8, 1995, during which the preferred alternative was presented and explained to the public, and questions and comments were taken for the record.

This Responsiveness Summary serves two purposes. First, it summarizes the comments of the public. Second, it provides responses to the comments on the Proposed Plan that were made at the public meeting and that were submitted in writing during the public comment periods.

3.1 OVERVIEW

The preferred alternative for OU2 at the former NOP site that was proposed by the USEPA and the USACE in the Proposed Plan, and presented during related public sessions, was focused extraction of groundwater and soil excavation.

Verbal public comments on the preferred alternative were documented at the public meeting on November 8, 1995. Eight comment letters were received during the public comment period.

In general, the public had differing opinions regarding Alternative 4 as the preferred remedial action alternative. Four written comments supported Alternative 4. Three written comments neither supported nor opposed the use of Alternative 4. One written comment opposed any pump and treat alternative which would include Alternatives 2 through 8.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

Prior to the public meeting in November 1995, efforts were undertaken to inform the public of steps toward remedial action at the site, and to involve the public in the decision-making process. Community relations activities increased in 1994 with the culmination of the investigation activities for OU1 and the decision-making regarding cleanup of soil at the site. Some of the major activities aimed at involving the community and obtaining their feedback have been:

1. A community survey of residents and local officials via on-site interviews, as well as telephone interviews, was conducted in January 1992.

2. A Community Relations Plan dated May 28, 1992 outlines the approach to be taken toward community relations and public participation.

3. Periodic fact sheets were mailed to the public in May 1992, June 1994, August 1994, and February 1995 to provide updates and additional information as necessary.

4. Public meetings were held in May 1989, June 1990, June 1994, and November 1995 to report on project progress and to solicit comments. Notices of these meetings were published in the Ashland, Wahoo, Lincoln and Omaha newspapers.

5. Two availability sessions were held at the site in June 1994 and February 1995 to discuss progress, answer questions and discuss concerns. The primary purpose of these sessions was to address OU1-related concerns; however, personnel familiar with OU2 activities addressed OU2-related concerns.

6. A public session was held in June 1995 to solicit comments on the OU2 Groundwater Containment Removal Action.

7. Technical Review Committee meetings are held periodically with representation by the USEPA, NDEQ, USACE, Lincoln Water System, Natural Resources District, Nebraska Department of Health, the University of Nebraska - Lincoln and the Saunders County Board of Supervisors.

8. An information repository was established at the Ashland Public Library in Ashland, Nebraska. Site information is also available at the USEPA office in Kansas City, Kansas and the NDEQ office in Lincoln, Nebraska.

9. A collect telephone line to the USACE was established so that the public can call to get questions answered without charge.

3.3 SUMMARY OF PUBLIC COMMENTS AND AGENCY RESPONSES

This Responsiveness Summary includes statements made at the November 8, 1995, public meeting and comments submitted to the USACE during the public comment period from October 30, 1995 to November 29, 1995. It also includes USEPA and USACE responses to those comments and questions.

Comments and questions have been paraphrased or quoted in italic text. Every attempt has been made to accurately preserve the intent of the comment and to include all issues raised. The letters in parentheses following the comments identify the commentors according to the Commentor Key following the Responsiveness Summary. All commentors who raised similar or related comments are identified.

The official public meeting transcript and written comments on file in the information repository at the Ashland Public Library in Ashland, Nebraska contain the verbatim comments from all commentors. The comments have been grouped according to common issues to avoid repetition in the responses, and the issues have been grouped into the following categories for ease of reference:

- Remedial Alternative Preferences
- Impact on Groundwater Supply
- Reuse of Treated Water
- Nitrates Contamination
- Current Ecological Impacts

3.3.1 Remedial Alternative Preferences

ISSUE 1. The identification of Alternative 4 as the preferred alternative was supported by the Nebraska Department of Environmental Quality and several residents living at or near the site. (A, G, I, L)

Alternative 4 will provide the best balance of trade-offs among alternatives with respect to the evaluating criteria established by the Superfund Law. Alternative 4 consists of the following elements: groundwater monitoring, potable water supply, hydraulic containment, focused extraction, and soil excavation and treatment. USACE, USEPA, and NDEQ concur that Alternative 4 will be protective of the human health and the environment, will comply with ARARs, will be cost effective, and will use permanent solutions and alternative treatment technologies to the maximum extent practicable. Alternative 4 will also meet the statutory preference for the use of treatment as a principal element.

ISSUE 2. It makes sense to eliminate the source of groundwater contamination and let the aquifer cleanse itself. I strongly agree with soil excavation and treatment and continued groundwater monitoring. (N)

Natural attenuation is a relatively slow process. For example, either the sources of TCE contamination ceased to release TCE to the groundwater sometime in the past or the current release is relatively minor, but the TCE plumes have continued to expand. Although natural attenuation processes have been acting on the TCE plumes, the expansion of the plumes means that beneficial use of the natural resource is continually being lost at an increasing rate. In addition, remediation is required to meet all of the applicable and relevant State and Federal laws and regulations. Therefore, it is appropriate to take action to remediate groundwater at the former Nebraska Ordnance Plant. However, the Superfund law provides a formal mechanism to change the selected remedy if it proves ineffective or if another technology is shown to be more appropriate. Currently, research is being conducted at other sites to evaluate a particular type of natural attenuation called intrinsic bioremediation. The results of this and other research is the type of information that may be considered during future evaluations of the clean up progress at the former Nebraska Ordnance Plant.

The excavation and treatment of explosives-contaminated soil concurrently with OU1 remedial activities will reduce the potential for the soils to contaminate groundwater. It is estimated that both cost and time savings will be realized by this action.

Data from groundwater monitoring is used to evaluate changes in the distribution of groundwater contaminants with time. Such information is important when assessing the effectiveness of the groundwater remediation. Additionally, groundwater monitoring is used to determine when groundwater drinking water supplies need to be treated or replaced at local residences.

ISSUE 3. Where has pump and treat groundwater remediation been attempted and where has it been successful? Is this going to be an experimental site? The cost of the remediation is too high when the remediation will probably not succeed. (N)

Remediation of groundwater contamination by pumping the contaminated water from the aquifer and subsequently treating the water to reduce the contaminant concentrations are proven technologies.

According to a study published in 1994 by the National Research Council Committee on Ground Water Cleanup Alternatives, 73 percent of the cleanup agreements at Superfund groundwater contamination sites specified pump and treat strategies. The same study suggests that pump and treat strategies are effective at stopping the spread of groundwater contamination and have mixed results for reducing contaminant concentrations to the cleanup goals in a "reasonable" time. Alternative 4 includes a pump and treat process called hydraulic containment to stop the spread of contamination. A second pump and treat process called focused extraction was included as an element of Alternative 4 so that groundwater is removed from areas with relatively high TCE and/or RDX concentrations.

The following list summarizes some on-going pump and treat remediation projects implemented by Federal agencies at Federal facilities. Typically, these remediation projects are large sites which require decades to restore. Therefore, the projects may be considered successful to date, although complete restoration has not yet been achieved.

- McClellan Air Force Base, California, Operable Unit B/C - Approximately 660 million gallons of TCE-contaminated groundwater were extracted and successfully treated in 7 years. The system consists of 7 extraction wells and has been operational since 1988.

- McClellan Air Force Base, California, Operable Unit D - TCE-contaminated groundwater has been extracted using 6 wells as a part of a large-scale cleanup. The cleanup system, which also includes treatment of the extracted water, has been operational since 1987.

- Twin Cities Army Ammunition Plant, Minnesota - Approximately 1.4 billion gallons of TCE-contaminated groundwater were extracted and treated between the October 1991 and September 1992. The ongoing cleanup is expected to take between 50 and 70 years.

- U.S. Department of Energy Kansas City Plant, Missouri - TCE-contaminated groundwater has been extracted and treated since 1983. Approximately 11.2 million gallons of groundwater were extracted during 1992.

- U.S. Department of Energy Savannah River Site, South Carolina, A/M Area - 198 million gallons of TCE-contaminated groundwater have been extracted and treated annually by a system that has been operational since 1983.

In Nebraska, a pump and treat system is currently being designed to remediate explosives contaminated groundwater at the Cornhusker Army Ammunition Plant near Grand Island. It is estimated that eight wells will extract a total of 1,650 gallons per minute from a 2,000 acre area of contamination.

The use of this remedy at the former Nebraska Ordnance Plant is not experimental. The use of proven groundwater remediation technologies is being employed to accomplish specific objectives. Unproven, experimental, or research and development-type processes have not been used for this remedy.

Remedial action is required to ensure overall protection of human health and the environment. Remedial action will also restore a valuable resource to its beneficial use. Remediation is also required to meet all of applicable and relevant State and Federal laws and regulations. The Superfund law requires that the clean up activities be reviewed periodically. If at the time of the review, the existing technology is not effective or a new, more effective technology is available, changes to the remedy can be made. Pump and treat is the only feasible containment technique presently available for sites with such large areas of contamination.

As discussed in the response to Issue 1, Alternative 4 provides the best balance of trade-offs among the alternatives with the respect to the evaluation criteria which include cost. The costs estimated for Alternative 4 are reasonable for the magnitude of the pump and treatment system which is being developed.

ISSUE 4. University of Nebraska faculty members are doing wetlands research at the Agricultural Research and Development Center, and remediation of TCE-contaminated water using alfalfa or cattails has been researched at the University of Kansas. The two research concepts should be combined to treat contaminated groundwater at the former Nebraska Ordnance Plant. (M)

Constructing a wetlands and using plants to remove TCE and explosives contamination is not feasible at the former Nebraska Ordnance Plant for the following reasons:

- The use of plants for treatment of explosives and TCE contaminated groundwater is not a proven technology. Existing research has not proceeded past the pilot study stage and involves the in-situ remediation of groundwater. At the former Nebraska Ordnance Plant, the depth to groundwater is greater than the depth of the root zone, and in situ treatment is not feasible.

- The growing season at Mead is not year round, and it is not feasible to store the large quantities of water for subsequent treatment that would be extracted during the off season.

ISSUE 5. Sulfur dioxide should be injected into the aquifer to form sulfurous acid which in turn will remove TCE from the groundwater. (L)

Theoretically, TCE will hydrate in the presence of sulfurous acid. The products of the hydration will include other chlorinated compounds. Use of sulfurous acid to treat TCE-contaminated groundwater is not a proven technology for remediating environmental contamination. From a practical viewpoint, the injection of acid into the aquifer in large quantities would lower the pH of the groundwater to unacceptable levels.

ISSUE 6. A pilot study of treatment processes should be conducted before full scale design is initiated. (C)

Bench-scale treatability studies are currently being conducted for two of the potential treatment processes, granular activated carbon adsorption and advanced oxidation processes. The treatability study data will be used to select the type of groundwater treatment option prior to the design of the treatment plant. If advanced oxidation processes are selected, pilot scale studies may be required prior to full scale design.

ISSUE 7. There is a threat to human health if individuals come in contact with the extracted water before it reaches the treatment plant. (M)

The potential for contact with the water before it reaches the treatment plant would be in the event that the pipeline breaks. Extraction wells would be shut down and breaks would be repaired rapidly by workers following an appropriate set of health and safety protocols. Generally, the threat to human health identified in the Baseline Risk Assessment at the former Nebraska Ordnance Plant is based on chronic exposure to the contaminated water. If an individual were to be exposed to contaminated groundwater during a pipeline break, the period of exposure would be so short that there would be negligible and immeasurable threat to human health.

ISSUE 8. Will untreated water be discharged to surface streams? (I, M)

Untreated groundwater will not be surface discharged during the normal operation of the remediation system. In the event that treated groundwater is surface discharged, the treated groundwater will be monitored prior to discharge to insure that treated water whose quality does not meet the acceptable discharge standards is not released.

ISSUE 9. The chemicals present in the groundwater are known carcinogens. (M)

The chemicals of concern in the groundwater and their corresponding USEPA weight-of-evidence carcinogenic classification are:

- Methylene chloride - B2
- 1,2-dichloropropane - B2
- Trichloroethene (TCE) - B2
- 1,3,5-trinitrobenzene (TNB) - None
- 2,4,6-trinitrotoluene (TNT) - C
- 2,4 or 2,6-dinitrotoluene (DNT) - B2
- Hexahydro-1,3,5-trinitro-1,3,5-triazine(RDX) - C

The chemicals classified as B2 are probable human carcinogens based on sufficient evidence in animals and inadequate or no evidence in humans of carcinogenicity. TNT is classified as C which means that TNT is a possible human carcinogen based on limited carcinogenicity in animals. TNB has not been classified due to a lack of data.

Although none of the chemicals have been classified as known human carcinogens (Class A), Class B2 chemicals present at the site are considered probable human carcinogens. The B2 classification is based on sufficient evidence in animals and inadequate or no evidence in humans of carcinogenicity.

ISSUE 10. The City of Mead water supply should be monitored. (K)

Since the wells that supply water to Mead are located outside the area of groundwater contamination associated with the former Nebraska Ordnance Plant, they are not a part of this project. However, Mead's water supply is a public water supply which is regularly monitored for contaminants in accordance with federal Safe Drinking Water Act and the Nebraska Safe Drinking Water Act. Questions concerning both the historic and current water quality should be addressed to the village of Mead, or to the Nebraska Department of Health at (402) 471-2541.

ISSUE 11. Why is it taking a long time to clean up the groundwater? (J)

The Superfund process of site cleanup includes a number of procedures intended to ensure that public and private funds are effectively used to mitigate unacceptable threats to human health and the environment. These procedures are commonly time-consuming.

At the former NOP site, approximately 23 billion gallons of groundwater are contaminated above acceptable levels. Much more than 23 billion gallons of groundwater will have to be removed before the aquifer is cleaned up. It will require decades to remove that quantity of groundwater via numerous wells. However, the groundwater contamination occurs in distinct bodies, called plumes. At the former NOP site, some plumes are considerably smaller than others, and the smaller plumes will be cleaned up more quickly than the larger plumes. For example, it is estimated that Alternative 4 will clean up the TCE plume with the suspected source at the AFBMD Technical Area and the overlapping explosives plume in a few decades, the explosives plume with suspected source at Load Lines 2 and 3 will take more than twice as long to clean up, and the TCE plume with the suspected source at the Atlas Missile Area is estimated to take 130 years to clean up.

Prior to the selection of the remedy represented by this Record of Decision, efforts were planned to stop the spread of TCE contaminated groundwater at the former NOP site. These efforts are called the Groundwater Containment Removal Action.

ISSUE 12. Currently, the Army is providing treatment units to the ARDC and homeowners whose wells contain unacceptable concentrations of RDX and/or TCE. The treated water has an offensive odor and taste. (G, J)

The Army is supplying bottled water to the private residences where the aesthetic quality of the treated groundwater is unacceptable. The Army has either supplied water to residences or replaced the carbon in treatment units with aesthetic problems. Similar actions will be taken in the future if problems arise. The Army is committed to resolving potential future problems associated with treated water in a timely manner.

If beneficial reuse is selected as the treated groundwater disposal option, a rural water district could be used to supply water to locations whose groundwater contains unacceptable concentrations of Department of Defense-related contamination.

ISSUE 13. Does the transfer of contamination from the groundwater to the atmosphere during treatment pose an unacceptable threat to human health? (G)

If the selected treatment process includes the transfer of volatile organic chemicals from the groundwater to the atmosphere, the airstream will be treated, if necessary, so that it does not pose an unacceptable threat to human health.

ISSUE 14. What is potable water? (N)

In the context of the remedial alternatives considered for the former NOP site, potable water is drinking water where the Department of Defense-related chemical concentrations have been reduced to or below acceptable levels. For example, the concentration of RDX would have to be reduced to or below the Lifetime Health Advisory.

ISSUE 15. Soil excavation and treatment should be combined with Alternative 2 to create a new alternative. This new alternative would remove the current source of groundwater contamination and prevent the existing contamination from expanding. After 20 or 30 years, there is some potential that a yet to be discovered technology can then be used to clean up the contamination more effectively and less expensively than today's technologies. (H)

Soil excavation was not combined with Alternative 2 because it was estimated that the contaminated soil would stop being a source of contamination by the time that Alternative 2 cleaned up the existing groundwater contamination.

As far as waiting for new technologies to be invented and proven effective, the Superfund Law requires that the clean up activities be reviewed periodically. If at the time of the review, the existing technology is not effective or a new, more effective technology is available, changes to the remedy can be made.

3.3.2 Impact on Groundwater Supply

ISSUE 16. What actions will be taken to prevent shortages of groundwater at irrigation and domestic wells? What action will be taken if irrigation and domestic wells go dry? (E, F, G, I, J, D)

Mathematical modeling will be used to predict the aquifer drawdown at domestic and irrigation wells. Seasonal aquifer stresses caused by irrigation and regional aquifer stresses resulting from a hypothetical drought season will be included in the analyses. The drawdown predictions will be used to locate extraction wells and to develop extraction well operation plans with the intent of managing aquifer drawdown. For example, focused extraction wells will be located where there is a relatively low potential that the remedial pumping will cause unacceptable drawdown at supply wells, and the operation plans may indicate that focused extraction pumping will be reduced or stopped during the irrigation season. Data will be collected after the start up of the remedial pumping system, and the operation of the system may be modified in response to that data to effectively manage the aquifer drawdown.

It may not be feasible to mitigate negative drawdown impacts while maintaining the effectiveness of the hydraulic containment system. In the event that remediation pumping has a negative impact on the ability of local supply wells to produce water at current use levels, the negative impact will be evaluated and addressed by the Army. The details of determining impacts on groundwater availability and responses to the impacts will be better defined during the Remedial Design process.

ISSUE 17. Potentially, future development of groundwater resources will be limited. (D)

The implementation of a pump and treat groundwater remediation system does not preclude the future installation of water supply wells.

Locally, groundwater is produced from the Todd Valley aquifer, the Platte River alluvial aquifer, and the Omadi Sandstone aquifer which underlies the other two aquifers. Only a fraction of the water available in the Todd Valley aquifer and the Platte River alluvial aquifer will be extracted as a result of remediation pumping. The water remaining in those aquifers and virtually all of the Omadi Sandstone water will remain available for future development. The Lower Platte North Natural Resources District has been guardedly optimistic that groundwater is available for future development. Water levels measured by the Lower Platte North Natural Resources District in Todd Valley irrigation and monitoring wells have shown that there has been very little decline in groundwater elevations during either dry or wet years.

In the event that remediation pumping has a negative impact on future groundwater development, the operation of the remediation system may be modified to some degree without hurting the effectiveness of the hydraulic containment system.

3.3.3 Reuse of Treated Water

ISSUE 18. A beneficial reuse for the treated groundwater should be developed so that the water is not solely discharged to a surface stream. (C, E, G, F)

The selection of the treated groundwater disposal option, either surface water discharge or beneficial reuse, will be made during the remedial design analysis and will be based on the following criteria:

- Cost/benefit analysis
- Technical feasibility
- Public acceptance

The types of beneficial reuse which may be considered include reinjection into the aquifer, agricultural use (irrigation, livestock watering, processing, or other use), and water supply (including supply to a potential rural water district, the ARDC, a nearby community or municipality, or some combination of these potential water users).

A Saunders County Rural Water Project Committee has been formed to evaluate the beneficial reuse options related primarily to water supply. Mr. Larry Angle of the Lower Platte North Natural Resources District chairs the committee. Other organizations which are represented on the committee include the Army, the University of Nebraska, the Nebraska Department of Environmental Quality, the City of Ashland, the Lincoln Water System Saunders County Board of Supervisors, Wahoo Utilities, and the Nebraska Department of Health. One of the committee's activities includes conducting a study to determine the economic feasibility of constructing and operating a number of different water distribution systems. The study area encompasses Saunders County, and supplying water to the City of Lincoln is included in some of the study scenarios. The study has been funded by a combination of local funding and matching federal funds. The study was initiated when matching funds were received from local communities, and it is estimated that the study can be completed approximately January 1997. If the study is completed in time to incorporate into the Remedial Design (approximately January 1997), the results of the study will be considered when choosing between surface water discharge and beneficial reuse during the future remedial design analysis. If not, the Army will either gather the necessary information directly, or choose not to pursue beneficial reuse.

ISSUE 19. Discharging 4 million gallons of water a day to Clear Creek during flooding will cause a negative public reaction. (I)

The impact of discharging water on Clear Creek water levels has not been quantitatively evaluated because the total combined flowrate from the extraction wells has not been calculated. However, a depth analysis was performed as a part the Groundwater Containment Removal Action. That analysis showed that a discharge of 5 cubic feet per second, which is approximately 3.2 million gallons per day, to Clear Creek during a flood flow would increase the water depth in the channel approximately 0.24 inches. If surface discharge is used for disposal of treated water, the remedial design will include a water depth analysis. If the results show that the discharge of the treated water during specific flood conditions may cause overtopping of the levees along the creek, the remedial design may specify that discharge of the treated water to the creek cease during such flood conditions. The remedial design will also include an analysis of the overall effectiveness of the hydraulic containment system when pumping is stopped temporarily, as would be the case if it was temporarily not possible to dispose of the treated water.

In addition, the Army has contacted Mr. Dean Busing, President of the Clear Creek Drainage District, to inquire about the board's reaction to discharging treated water to Clear Creek. Mr. Busing indicated that the Drainage Board did not perceive that significant problems would develop from the potential discharge of treated groundwater to the creek. However, public acceptance is one of the three criteria that will be used to select the treated groundwater disposal option. The selection criteria are discussed in the response to the preceding issue.

ISSUE 20. A rural water district should be developed. What area would the rural water district serve? (F, I)

A rural water district is among the scenarios included in the Saunders County Rural Water Project Committee feasibility study. Although the Natural Resources District is the agency associated with establishment of rural water districts, USACE anticipates that any potential future rural water district would include provision of service to residents whose water was contaminated with TCE and/or explosives.

ISSUE 21. The treated water should be reinjected into the aquifer. (I)

Reinjection of treated groundwater is being considered as a beneficial reuse option.

3.3.4 Nitrates Contamination

ISSUE 22. Nitrate contamination is a big problem. Groundwater treatment should address nitrates in addition to TCE and explosives. (C, G)

Nitrates contamination is a regional problem which did not result from Department of Defense-related activities. Therefore, USACE does not have the authority or means to expend funds for nitrates treatment.

The State of Nebraska has the responsibility to address nitrate contamination. All of the Lower Platte North Natural Resources District will be established as a Groundwater Management District beginning in January 1997. Some of the activities associated with the Groundwater Management District will focus on preventing future problems associated with high nitrate levels. Additional questions regarding regional nitrates contamination should be addressed to the Natural Resources District, the Nebraska Department of Environmental Quality, or the Nebraska Department of Health.

ISSUE 23. Who has the responsibility for remediating nitrates contamination that migrates to areas which would normally not be contaminated if Department of Defense-related groundwater remedial activities did not change groundwater flow patterns? (D)

The hydraulic containment and focused extraction components of Alternative 4 rely on regional groundwater flow to be effective. These components will not change the direction of the regional flow, and nitrates contamination will continue to follow the regional flow patterns. Therefore, areas outside of the regional groundwater flow path will not become contaminated.

3.3.5 Current Ecological Impacts

ISSUE 24. A species count was not performed as a part of an Environmental Impact Statement. (M)

An environmental impact statement is normally performed to fulfill the requirements of the National Environmental Policy Act (NEPA). The work performed at the former NOP site conforms with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act, and its governing regulations, the National Contingency Plan. The CERCLA process satisfies NEPA requirements, and an Environmental Impact Statement is not required at the former NOP site.

An ecological risk assessment was performed for the former NOP site. The risk assessment focused primarily on ecological exposures to contaminants in surface soils, sediment, and surface water. Exposure of ecological receptors flora and fauna to contaminated groundwater was considered unlikely, except through crop irrigation, and was not addressed specifically. The assessment did not identify any unacceptable risks to ecological receptors.

SUMMARY OF COMMENTORS

Public Meeting, November 8, 1995

The following people made oral comments:

A Ed Louis (NDEQ)
B Larry Angle
C Jerry Obrist
D Dan Duncan
E Doug Irvin
F John Kirchmann
G Mrs. Jerry Proctor
H Dwight Hanson
I Harold Kolb

The following people made written comments at or outside of the public meeting:

D Dan Duncan
F John Kirchmann
I Jerry L. Proctor
J Vi Irvin
K Marilyn Benal
L Ross H. Rasmussen
M Katherine A. Saniuk
N Joe Schlueter